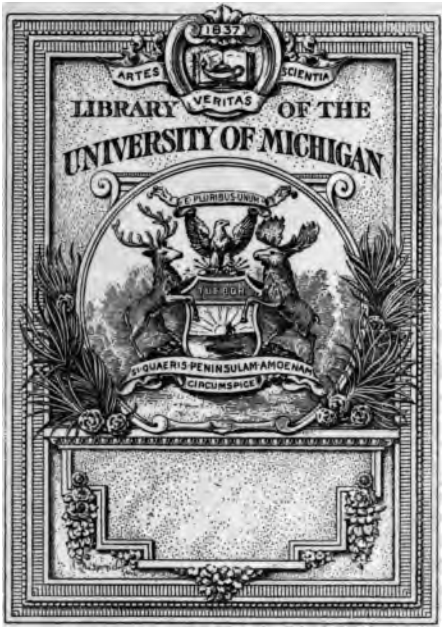
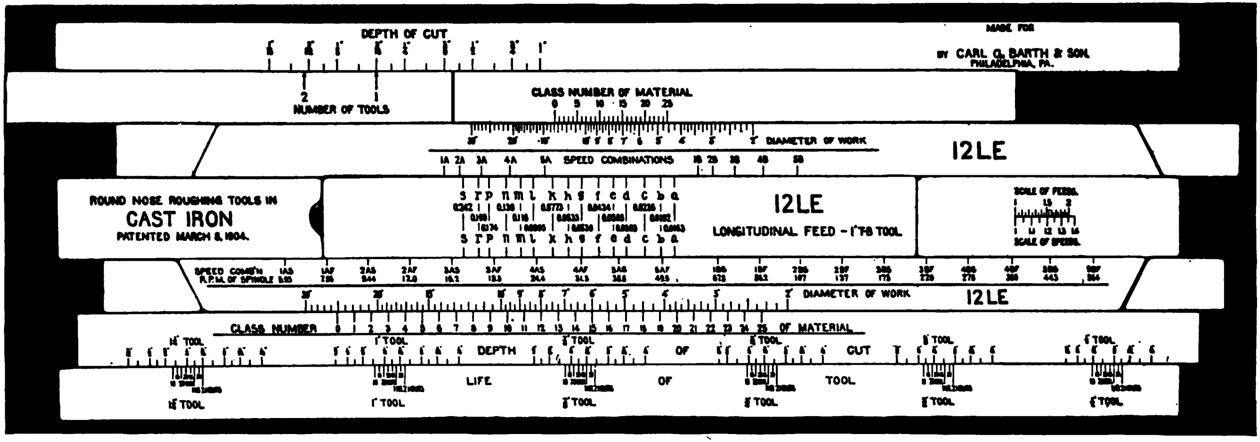

1837
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE



Slide rule for setting machines in machine shops. A great invention, one of many that have accompanied the progress of scientific management. The following twelve variables enter into the determination of the most economical way to do a piece of metal lathe work, and their solution was practically blind guess until the coming of the slide rule: 1, size and shape of the tool to be used; 2, the use or not of a cooling agent on the tool; 3, the number of tools to be used at the same time; 4, the length of time the tools are required to stand up to the work (life of tool); 5, the hardness of the material to be turned (class number); 6, diameter of this material or work; 7, the depth of cut to be taken; 8, the feed to be used; 9, the cutting speed; 10, the cutting pressure on tool; 11, the speed combination to be used to give at the same time the proper cutting speed and the pressure required to take the cut; 12, the stiffness of the work. Courtesy of Carl Barth & Son.

THE ELEMENTS OF INDUSTRIAL MANAGEMENT

BY

J. RUSSELL SMITH, PH.D.

PROFESSOR OF INDUSTRY, WHARTON SCHOOL OF FINANCE AND COMMERCE,
UNIVERSITY OF PENNSYLVANIA
AUTHOR OF "INDUSTRIAL AND COMMERCIAL GEOGRAPHY," "THE OCEAN CARRIER,"
"THE STORY OF IRON AND STEEL"

PHILADELPHIA AND LONDON
J. B. LIPPINCOTT COMPANY

PRINTED BY J. B. LIPPINCOTT COMPANY
THE WASHINGTON SQUARE PRESS
PHILADELPHIA, U. S. A.

INTRODUCTION

WHAT does the manager of an enterprise do? Chiefly he makes decisions. Then he may or may not see to their carrying out. Others may do this for him, but they cannot make the big decisions for him.

How does a man learn how to do this deciding? Chiefly by experience, which is the great and the expensive teacher of men in worldly things. It is possible, however, that a man may acquire experience much faster if he knows the principles that underlie his work. With the object of training young men in the principles that underlie the problems that face the works manager, the Wharton School of Finance and Commerce in the University of Pennsylvania has for some years been giving a course called Industrial Management.

This book has grown out of that course, and it is being published in the hope that it may be of benefit to young men who are at work and have not the prospect of attending this kind of a college.

I wish to express my appreciation of the kindness rendered by Dr. F. W. Van Meter in reading the manuscript and making editorial changes and suggestions.

J. RUSSELL SMITH.

UNIVERSITY OF PENNSYLVANIA,
October, 1915.

CONTENTS

CHAPTER		PAGE
I.	Service of Organization in the Business Unit	1
II.	Rise of Modern Industry and the Labor Problem	12
III.	Types of Organization—The Partnership	22
IV.	Types of Organization—The Corporation and Its Powers	37
V.	The Management of the Industrial Corporation	42
VI.	The Advantages of Large Scale Production	56
VII.	Overhead Charge as a Management Factor	62
VIII.	Dumping of Product as a Profit Factor	70
IX.	Standardization of Pattern and Specialization	77
X.	How Big Should an Enterprise Be?	91
XI.	The Location of Industry	98
XII.	The Location of a Factory	111
XIII.	The Model Factory Town	114
XIV.	The Model Factory	124
XV.	The Quality of Labor	131
XVI.	The Man and the Job	145
XVII.	Standardization in Labor	166
XVIII.	Standardization in Labor Conditions	178
XIX.	The Wage Question	190
XX.	The Payment of Wages	194
XXI.	The Control of the Working Force	211
XXII.	Reorganizing Works	229
XXIII.	Symbols and Records	243
XXIV.	The Wage Problem	256
XXV.	Industrial Management Outside the Works	268
	Index	283

THE ELEMENTS OF INDUSTRIAL MANAGEMENT

CHAPTER I

The Service of Organization in the Business Unit

Within the past few years we have heard steadily increasing complaint that the opportunities for young men are not what they used to be. This is perfectly true, because throughout the last century the young men of America were free to take Horace Greeley's famous advice, "Go West, young man, go West." When the young man had gone West he could get a farm for nothing, and, removed from the competitive conditions of the East, could, with an initial capital consisting only of energy and perseverance, get in on the ground floor and win a fortune. He did not compete for a factory job back East and put wages down. Now much of the free land that was given away twenty to fifty years ago sells for $200 an acre, and the problem of getting a start in life is for the young man a very different matter. This disappearance of opportunity for agriculture is matched by the similar difficulty in getting hold of timber lands, ore lands, coal lands, and practically all the resources which create the opportunity for industry and easy wealth. Where shall the present generation turn for relief? Plainly, since there are no more continents to take, we must begin the better utilization of what we have. The American is now famed as the world's greatest waster.

Our past abundance of opportunity has caused us to live in a perfect carnival of waste.

This charge can be proved in two ways and shown in two entirely different fields: first, by going around and pointing out an almost endless succession of manifest wastes; and, second, by comparing our producing abilities with the returns. Compare, for example, the actual power of the average worker to produce per day with the producing power of the average worker when the United States ceased to be a colony and became a nation. It was about that time that spinning machines were invented. Before the coming of these machines, the weaver made one or two threads slowly by hand. Now a spinning machine is as big as a room, and its little whirling spindles are sometimes as many as twelve thousand in number, so that in place of the two threads of the Revolutionary ancestor there are now the twelve thousand of the present spinner. Going on through the list of industries, we find in almost every case a many-fold increase in producing power of the worker. The power loom is many times as productive in yards of cloth as the old hand loom. A government statistician has recently announced that in 1830 it took 186 minutes of labor to make a bushel of wheat, while in 1896 it required but 10 minutes. Typical of this general multiplication of man's power is the well-known superiority of the locomotive over the old wagon that it superseded, and of the steamship over the slow sailboat of the past. A locomotive and train crew carry 1200 to 2500 tons of freight, when the same number of men with teams would have hauled 8 to 15 tons much more slowly.

It is safe to say that the present worker can turn out ten to twenty times as much as his Revolutionary forebear.

But do we have ten or twenty times as much goods? By no means. Why is this? The answer, I think, is plain waste.

Waste Through Lack of Correlation.—We have not yet learned how to secure efficient correlation of our new inventions. The spinner can spin, the weaver can weave, the farmer can grow grain, the locomotive engineer can, with his train crew, carry 2500 tons of freight, but all these things have not yet been hooked together to get the greatest industrial service. It is a relatively simple thing to invent labor-saving machines, but it is a very complex matter to finally get the whole mass of them working together to the greatest service of all the people engaged.

Correlation is a kind of invisible relationship, difficult to work out. Perhaps it can be best illustrated by noting the construction of the animal body. The jelly-fish is a mass of cells all alike and therefore without organization. If he happens to come in contact with a little fish, he will wrap himself around it and digest it. The other side of the mass of jelly-fish will digest something equally well. It is all stomach, all legs, all an unorganized mass which if broken in two by the waves becomes two jelly-fish.

In contrast to this we have the vertebrate animals having many correlated organs. An eighteenth century scientist made the world stand aghast by announcing that a bird was a man flying, that a horse was a man walking on hands and feet. He had merely discovered that the foreleg of the horse, the arm of the man, and the wing of the bird were all modifications of the same organ, with great similarity of structure in fundamentals and great variation of detail to meet different purposes. The giraffe and the elephant have modified certain parts of their anatomy to reach the limbs of trees; the snake, like them, has a liver,

lungs, and heart, but they are shaped to fit into a body that has been evolved for a peculiar kind of travel.

A steamship and a hotel are two examples of highly-developed correlation of parts. Each is made to shelter, feed, and keep comfortable a lot of people, but one of them has the freedom of land space and stability, while the other must travel on the uncertain sea. The result is that, while they have essentially the same organs plus locomotion in the case of the ship, the ship has great pressure demanding that the many functions must be carried on without fail for a moment. As a result we have in the modern steamer the most highly correlated piece of equipment built by man. It may well serve as a splendid example of the problem of industrial management, which is demanding a similar efficient correlation of numerous different functions to attain the definite final end of the organization. It should be noted, too, that we have the high correlation of the ship adapted and modified, in accordance to the needs of various functions, such as the carrying of passengers, the operation of fighting machines, the discharge of torpedoes, the freezing of cold-storage meat, and so on. Similarly a group of men who make an organization have different parts of the organization or different functions highly developed, just as has the giraffe or the elephant. Thus one corporation may have a large sales department, another may have almost none, but a very large accounting department.

There are numerous examples of men in the same town engaged in the same kind of manufacture, using the same kinds of machines, made by the same firms, using the same raw materials, making practically the same kind of output, competing in the same labor market and selling in the same market, yet one is making large profits, and the other

little or none. The difference is often due to the amount of skilled foresight used in the correlation of various parts of the enterprise.

The Difficulty of Correlation in Organization.—Perhaps this correlation looks like a very simple matter. It is, however, exceedingly complex and difficult, the chief reason being the great and really surprising limitation of the human mind. We made progress not rapidly, but with surprising slowness. Our minds seem to be down in a rut as a stream is down within its banks which forever confine it. The number of new things that the mind can devise, or even see when they have been devised and placed in view, is small, and the range of deviation that we can make from the straight-away start is small. This, I think, will be proved by noting the way inventions develop. We had the engine for half a century before men were *smart* enough to put it on wheels and make it run on a track. After this was attained it took us three generations to get the engine on wheels, and the wheels sufficiently developed to run comfortably along the road in the form of the automobile. And this result was obtained only after the steady striving of hundreds, if not thousands, of machinists and inventors through the period of these three generations. We have probably all noticed some invention that has made a man's fortune and have been struck by the extreme simplicity of the thing. We have thought to ourselves, "Why didn't I invent that?" and have comforted ourselves by the thought that we would have if our minds had just been focussed on that problem. But the point is that our mind did not so focus itself. Note the further fact that the so-called great inventions are not single inventions. They are the result of many inventions. The locomotive has changed

more in the last twenty-five years of its life than it did in the preceding fifty. It is the result of thousands of inventions, each making some little change.

Machines are tangible things and are really easier to see and to work upon than the thoroughly intangible thing which we call an organization, which is made up of relationships invisible, abstract, and therefore much more difficult to grasp and more difficult to improve. We have just come into an era in which we appreciate that here is a great field for work.

A New Organization Makes a Fortune.—It is probably true that almost every inventor of a new type of correlation in any line of action, whether it is war, sport, industry, or commerce, makes himself a conspicuous figure in the particular group in which he works. Alexander the Great conquered the world in a few years with the Macedonian phalanx, which was merely a novel and highly effective arrangement of troops. A small group of men were made an invincible unit for ploughing through the ranks of opposing forces, and empires fell an easy prey to a handful of soldiers and a bit of system.

A similar great success has resulted from the introduction of a single new factor into a mercantile business. I have talked with many persons who told me of the merriment and incredulity that greeted the first announcement in Philadelphia that a certain store would hereafter sell goods at one fixed price only; that the customers would therefore be making needless waste of time to attempt to bring about price reduction. People said it could not be done. The habit of having a chaffer and a price-beating bargain in the store was a habit firmly fixed and could not be changed. But it was changed, with very profound results. First, it

made a very great saving in the clerk's time. A customer who was in no rush could easily spend a half hour dickering with the clerk as to whether this pair of shoes could be had for \$4.00, \$3.50, or, finally, certainly for \$3.75. The fact that the shoes had the one definite price of \$4.00 removed from the transaction everything except the customer's making up his mind that the shoes suited him and that he could afford the price. Thus the time of the salesman was greatly reduced, but the indirect results of the change were far greater, and that is the significant part of the whole matter of improvement. A seemingly simple improvement has, first, some direct results, and, second, some contingent ones that are often far reaching, and which show their final results only after years.

The store in which every article is for sale at a variable price according to dicker is a regular jelly-fish for organization. Here is the proprietor in the back, and down front is James, the clerk. The proprietor wonders whether James gets \$4.00, \$3.50 or \$3.75 for the shoes, and there is no system of checks, balances, book-keeping processes, or auditing that can determine that fact. In many cases it lies only with James, the customer, and the Deity, and the two latter are rarely on speaking terms with the proprietor. Hence the only recourse is the primeval method of keeping a sharp eye on James. How far can organization go in that case? Once James has certain goods issued to him to sell at a fixed price, his cash returns and the goods on the shelf at the end of a week show exactly what he has done, and the store thereby at once becomes capable of expansion into departments capable of definite control through accounting, which is the great factor in the supply of information to the industrial or commercial firm of to-day.

The accounting and the cost-keeping are almost identical with the information service of an army. The general sits in some comfortable place far away from the noise and danger of his battle line. He must indeed be removed from danger so that his thinker can work effectively. Here focus telegraph and telephone lines, scouts bearing returns from reconnoitering parties, the reports of aviators, all bringing to this one desk the information which enables the commander to picture in his mind and mark on his maps the situation prevailing among the companies, regiments, brigades, divisions, and armies comprising half a million men scattered over a territory as long as from Philadelphia to Washington and miles in width. With this information in hand he is in a position to command his army. The manager of a department store or of a great producing works sits back in his quiet office, supplied by information brought to him largely through the methods of accounting, which show him the conditions in various departments, the changes that are needed to maintain and improve the efficiency of this large group of complexly correlated parts. The accounts tell him things he could not see with his own experienced eyes even if he inspected the whole enterprise every hour of the day.

Examples of New Correlation.—One of the surest ways to great success is to get a new and more efficient type of correlation. Thus Mr. Andrew Carnegie became the possessor of $340,000,000 of 5 per cent. bonds chiefly because he was the first to do the same thing in iron making that certain merchants had done in the department stores; namely, integrate a number of independent businesses into a more efficient whole. Thus, from buying his limestone, ore, coke, and coal in the open market and having them hauled

by common carriers, be became the possessor of his own coal mines, lime quarries, coke ovens, ore mines, steamships, and railroads, and attained a degree of efficiency not otherise attained. Hence the $340,000,000, which came from the control of the situation at the time of the foundation of the Steel Trust.

Another example of this same process, much simpler, less spectacular, but equally efficient, has been worked out by a certain Philadelphia grocer. He, like many another person, was impressed by the waste of time involved when a customer comes in and inquires after the price of, let us say, apples. The customer carefully examines the stock and discusses each variety, its qualities as a variety, the excellence or otherwise of the particular barrel, and then, after thinking the matter over and talking to the grocer, decides to buy one-quarter peck from barrel No. 4. Then, as the grocer picks them out in the customer's presence, he must be very careful to give no offence to the customer's choice and must drop any apple that the customer challenges, with the result that he has left on hand some part of his stock with salability injured. Furthermore, he has spent a considerable fraction of his time in walking needlessly about the store, a large fraction in talking with the customer, and a small fraction in doing the actual work of measuring out the goods. The contrast to this is another store limiting itself almost entirely to fruits, buying them in quantity, sorting them in a back room into various grades, qualities, and sizes of packages, which are placed upon the counter with the price marked. The customer can come in and look at them, and decide to take this or that package. It is dumped, and the transaction is over. By this means the clerks can do up packages in their leisure time,

the number of clerks in proportion to the output can be greatly reduced, with the result that cheaper prices can be given, and the old-fashioned grocery store finds it virtually impossible to compete with this new type which is rapidly spreading and making its inventor rich.

These examples will perhaps make clear that the matter of correlation of parts is a problem universal almost in human activity, and one in which we have but begun the solution of difficulties that will be with us for generations, for each new invention gives us new units to correlate, and the correlation at best is slow.

Science versus Genius.—It is the appreciation of this problem which has created such a tremendous interest in the problem of efficiency, on which books by the dozen and magazine articles by the hundred have already been written. The work of active revolution has, however, but begun. We still see the old and the new type side by side. The old idea was to get a good man and turn him loose. "He'll do the work." This is virtually a dependence on genius. There are still firms with a sales organization worked on that basis. They engage a salesman, give him samples of the goods, tell him to go and sell them. He goes and does his best. Other firms with the same problem realize that the selling of goods is a psychological problem in which there is very small chance of the newcomer making the best solution. How shall the green young man convince the housekeeper that she does need this book, and, when she has said she has not the money to pay for it, convince her that she has? Maybe the nice-looking young man can do it, but when we get our leg broken we don't send for the capable-looking young man, or the sensible man, or the genius. We send for the man who has studied

the art of fixing broken legs. So the most efficient firms that face the problem of selling or producing goods have got away from the old-fashioned notion of getting a good young man and turning him loose. They have learned the important lesson that there is a one best way of doing everything, and an indefinite number of wrong ways. Attempts are made by careful study to define the best way and then teach that way to those who do it—the scientific method thus replaces the old-fashioned dependence on genius.

A Definition of Efficient Management.—An enterprise has efficient management when each part or division is properly correlated or co-ordinated with each of the other parts and when each part is raised to the maximum of efficiency. This can happen only when each worker is working at the maximum of efficiency.

CHAPTER II

The Rise of Modern Industry and the Labor Problem

What is history? When I read it as a school-boy, it seemed to consist of one long series of battles. The French and Indian War practically connected with the Revolution, which almost connected with the War of 1812. Then there were just a few pages of uninteresting stuff and the Mexican and Civil Wars were upon us. There wasn't much after that, and what there was I didn't understand. But all these battles were merely symptoms of underlying movements. What were *they?* It is the underlying movements that are history. The other things are but symptoms, as a headache may be a symptom of a fever, or a cold, or a shock, or an overloaded stomach or many other more or less fundamental conditions.

This generation is discovering that the force underlying history is primarily the economic or industrial force. The great English historian Macaulay, who contrasted the prosperity of Edinburgh and vicinity and the lack of prosperity of Rome and vicinity, and said it was due to the different kind of church that prevailed, probably made a great error. The man who describes American history as a series of wars is leaving his history untold. Why was it, for example, that for two centuries we clustered along the seashore and along the Eastern rivers, and then suddenly within the last one hundred years we have increased twentyfold in population and become possessors of the whole continent? The answer is to be told in the new mechanical inventions which permitted an industrial revolution.

The Old Domestic System.—During the past one hundred and twenty-five years the world has witnessed greater changes in industry and daily life (therefore in the forces that make history) than it had experienced in twenty centuries before. At the time of the Revolutionary War we had what historians call the "domestic system" of industry. It was the slow development of centuries and had had less change in any previous one hundred years than we now see in each succeeding five or ten. In the England of 1776 and also in America there was no such thing as the factory as we now know it. The manufacturing work was done in the home or workshop of the artisan. The spinner had a spinning-wheel in the kitchen, the weaver had a loom somewhere about his house, the shoemaker had his little shop and kit, and he could even pack up his kit of tools and go to the neighbor's to work. The saddler had a little shop, the wheelwright and blacksmith were by the roadside. The locksmith, and the gunsmith, and the cutler were similarly fixed. The potter had a few hand tools and could make simple wares.

In that day the fair was an important part of the commercial life of the community. I do not mean the present type of agricultural fair where you get the prize for a display of animals or vegetables. The eighteenth century fair was a place where everybody went to buy and sell, as they yet do in many parts of Europe, especially in Russia, where nearly every small town has its fair or market day at frequent intervals. Some of the larger cities have annual fairs that last a month and are visited by merchants who come hundreds of miles and do their year's business. From time to time some member of an artisan's family,

often the wife, would take a pack-horse loaded with wares to the eighteenth century fair to sell.

Factory Legislation.—Those persons who think that the present outbreak of legislation for the control of industry is something new are mistaken. It is merely one of those cases of history repeating itself. In the course of centuries, during the domestic epoch, there was worked out a very elaborate system of legislation for the control of industry. This was especially the case with regard to apprentices, who were a very important part of the system, furnishing their employer labor and aid in return for the teaching of the craft. The eighteenth century laws were, of course, made for the control of production under *domestic* conditions, and the present laws are arising to meet new conditions.

There even was a law passed in England before the settlement of any English colony in America which provided that every landholder outside of certain town locations should, in building a cottage for a workman, provide with it at least four acres of ground. This was a pretty stiff piece of the control of industry, and a very good piece, too, if the welfare of Englishmen was the object in view. The artisan had a place for chickens, pigs, and a cow, and some little crops beside. In the harvest season he left his home place and went off to help harvest the crops of the real farmers. Thus he had three jobs—farm laborer, cultivator of his own home place, and his craft. In all his home work, including his craft, and in the produce of his labor at the market town, and fair, he was often aided by the women, children, and old folks of his family.

The Industrial Revolution.—Into this age-long and well-established system came with great suddenness a series

of changes which gave us the "factory system" of manufacture and the change we call the "industrial revolution." We often mistakenly attribute all these things to steam. The fact is that the steam-engine had been sitting around thirty or forty years with almost nothing to do, because there were no machines for it to run. As early as 1740 it was used to run pumps for lifting water from coal mines, but there was virtually no manufacturing machine for it to run until about 1770, when a minister by the name of Arkwright, watching the process of spinning, conceived the idea of making a spinning device that would run by mechanical power rather than by human muscle. His invention was promptly followed by two others of almost equal importance, and within a decade (1770–1780) a spinning machine had been developed capable of making hundreds of threads of yarn at a time. The weavers were glutted with yarn, and, as necessity is the mother of invention, the next decade produced the power loom, which greatly cheapened cloth and made greater the demand for cotton. This demand was the necessity which in 1793 resulted in the invention of the cotton gin by a Connecticut school teacher, Eli Whitney, then residing in South Carolina. As a factor affecting human history, these inventions far outranked our Revolutionary War. The spinning and weaving machines revolutionized industry, commerce, finance, and politics in England, and a good showing could be made to prove that the single invention of the cotton-gin changed the whole course of American history by making slavery profitable, thereby making it the dominant question in American politics and bringing on the Civil War.

Spinning and weaving machines in England could be run much better in groups where one water-wheel or engine

could run many machines. Hence factories came into being. The wages of the hand weaver declined because he could not compete with power-driven machines. He had to give up his work in the cottage by the roadside and go off to the town where the factory offered him employment. In the domestic period the best place for manufacture was on the good agricultural land of South and East England. In the new factory epoch coal to drive the engine was the dominating factor in the location of an industry, and the centre of manufacturing shifted to the North and West of England, where a bountiful supply of fuel was to be found. In the space of a few years this section was dotted with busy manufacturing cities, and England dominated the cotton goods trade of the whole world. Conditions were peculiarly favorable at the close of the eighteenth and the beginning of the nineteenth century for the industrial and commercial advancement of the English people. An abundance of coal and iron mines, located near seaports where raw material could be brought into the country and finished goods sent out, created a natural situation which was unusually favorable, and the possession of a supply of ready capital and of the most highly developed mechanical contrivances made it possible to take advantage of the natural situation in an effective manner. Furthermore, on the continent of Europe the prolonged disturbance occasioned by the Napoleonic wars prevented any marked industrial development. England, though participating in the conflict, was at no time forced to feel the crushing burden of an invasion by a plundering, destroying army. Her industrial growth was not impeded by any physical contact with the war, and she was able to get a commanding lead over all her

neighbors. This was especially the case because her navy gave her control of the sea and many colonies.

The Appearance of the Capitalist.—During the domestic epoch the capitalist as we now think of him was peculiarly non-existent. The capitalist is a man with money to invest, and most of the investments of present-day capital are in the following classes of property: railroad stocks, railroad bonds, municipal traction company stocks and bonds, gas works, water works, factories. But during the domestic epoch none of these things existed. In the place of the factory we had the loom room in the artisan's house, or the kit of tools in the blacksmith's shop. The same man was capitalist and worker. In place of the railroad was the public highway. The gas works and the water works and the trolley-car company were non-existent. The chief thing for the wealthy to own was land, and wealth being power, we find that the landholder was the most powerful class. He therefore dominated England, made the laws, and, as a result of his financial domination, of course gained social dominance. The only way a newly-rich man could gain social position was to become a landowner and gradually work his family's way into the accepted social class, just as to-day we find the newly-rich American by ghastly means acquiring for members of his family titles of nobility which admit them to the older established groups of social exclusiveness.

After the coming of the factory system we find that the capitalist, possessing the manufacturing property, tools and equipment of industry—wealthier even than the average landowner—appears as a strong force in England, particularly in English politics and laws. His hand is seen in many acts of legislation, as, for example, in the so-called

Settlement Act, which made it very difficult for a workman to move from the locality in which he happened to live. Under this law the farmer or factory owner found it more easy to control his laborers, who were not free to avail themselves of such freedom from competition as they might get by going to other locations. The great output of the machines caused, for a time, an increase in wages, but soon caused a decrease, because the manufacturers could discharge the men and hire boys and girls to run the machines just as well. Wages during the first third of the nineteenth century declined, and the condition of the workers became bad in the extreme. Extensive recourse was had to public alms under a vicious system of so-called outdoor relief, whereby public money was given to the man who was unable to earn a living. It became a part of the manufacturer's system to say to the workmen, "Well, I can get you three shillings a week from the poor commissioners. You need twelve shillings altogether to keep you. I will give you nine." This utilization of public funds by the ring in power became a great national scandal and manifestly did not help the workers any. A good account of this can be had in Gibbons' "Industry in England," which has two chapters devoted to the Industrial Revolution.

Labor Unions and Labor Legislation.—In this period of the decline of wages, attempts of the workmen to meet, form organizations, and resist by strike or otherwise, were broken up under a conspiracy act which made it a crime for workmen to get together and discuss these matters. What had happened was that the old order had been broken down so suddenly and the new order had come up so suddenly that there was no chance to make the common-sense regulations, rules, and adjustments so necessary in human

relationship. When the work was in the home the child who helped was under the care of his parents. When the work went to the factory there was no provision for the care or protection of children, so that conditions of child labor arose which stagger our powers of belief. Parliamentary reports by the Seventh Earl of Shaftesbury show that children were worked twelve, fourteen, and eighteen hours a day. They were whipped to keep them at the machines. They were taken out of bed and carried back to machines and worked until they died. Employers went to poor commissioners to secure all the children they could get, the commissioners insisting only that they should take one idiot for every so many sound ones. When England discovered these things there began a series of restrictive laws tending to protect children and women, and finally men at work, until at the present time England, with the oldest factory system, is the country which probably has the most extensive factory legislation and the most universal trade unionism. Plainly, the trade union arose as a result of the abuses of the capitalist system, and it is a fact that it is only in unionized industries that wages have yet risen to the point where an unskilled worker in a modern city can support his family upon his wages.

The labor abuses of this period may perhaps give some one the excuse to say that capitalists are bad. That statement cannot stand alone. One can, however, probably say with safety that man tends to be a predatory animal and that he has not yet developed sufficient self-control to be trusted with unlimited authority in any field. The most grewsome part of the whole child-labor situation in England then as in England and America to-day is the fact that a large proportion of the violation of statutes was made

possible by the callousness and cruelty of parents, who wantonly perjured themselves to secure employment for their children, merely for the sake of the meagre wages the little workers could bring home from the factory or mill. It is a fact that we all buy things as cheaply as we can and sell them as dear as we can. That applies to our services as well as to our goods. The trouble in England was that under the unorganized new factory system the employers were in a position to exercise unchecked power, and abuse arose. There is no question whatever but that in many parts of the world similar unchecked power has for a time lodged in the hands of groups of workers who have shown themselves very human in their inability to make wise use of such authority. If this period shows us anything, it shows us that the present period of factory legislation has good reasons for its existence, and that neither the capitalist nor the laborer nor any other group of people can be trusted with dictatorial power over the other or over the community.

The Unit of Organization.—Under the domestic system the unit of organization was a man's time. The system was peculiarly effective because of the thorough provision it made for full employment. With his craft, his small farm, and his agricultural labor the workman could be busy every day in the year that he wished to work and there was little waste effort in getting produce from maker to user.

In modern industry, under our factory system, the unit of organization is not a man's time, but a machine's time. The problem of the manufacturer is to let the laborers come or go, but to keep his machines going as nearly continuously as possible so that a given capital can make greater output. This is an absolute necessity from the standpoint of the manufacturer, but it serves to bring out acutely the great

weakness of the factory system in comparison with the domestic system, namely, the problem of unemployment, which is one with which modern society is just beginning to grapple. It goes far to explain the great difference between the possibilities of comfort which we find in the modern community with its marvellous powers of production. There is little doubt, also, that the irregular employment of the modern factory system is largely responsible for the hundreds of thousands of vagabonds who in hopelessness and despair line the American highways and fill our morgues and dissecting-rooms.

CHAPTER III

Types of Organization—The Partnership

The factory system, bringing together the many machines under one roof, demands capital, and capital in large units. How shall it be collected and controlled? To solve this question various types of business organization have been devoloped, by which it is possible to secure the investment of the capital of many individuals in a single enterprise. There are three fundamental types of business organization; the individual entrepreneur, the partnership, and the corporation. During the period of the domestic system of industry the individual entrepreneur was the common type, the partnership the occasional type, the corporation almost unknown. With the expansion of business into larger and larger units the partnership and the corporation became more common until to-day only a relatively small part of the manufacturing, mining, and transportation business of the world is carried on by individuals. During the years immediately following the industrial solution the partnership increased rapidly in importance, but it was soon superseded by the corporation. But, while the corporation has long since become the dominant type of organization, the partnership is still a significant factor in the business world, possessing some advantages over other forms of organization. I cannot state these advantages better than in the words of Mr. Alba Johnson, who for a number of years has been head of the Baldwin Locomotive Works in Philadelphia, by far the largest locomotive manufacturers in the world, and also for many years the largest partner-

ship in the world. In a lecture at the Wharton School of Finance and Commerce, University of Pennsylvania, he said:

"I do not know of any other business, either in the United States or any other part of the world, where so large a business is conducted under the form of the old-fashioned co-partnership. All of the laws of modern legislatures are devoted to making it easy for men to go into business as partners, and limiting their liability so that in case disaster should befall that little company the loss cannot be greater than the amount of money actually put into it. Therefore it is necessary for those who are doing business with these limited liability concerns to make sure that the business is prosperous, and that the money necessary to make good its obligations is there, because if it is not there the creditor has no recourse whatever to the persons who are behind that business. The Baldwin Locomotive Works is organized on the other principle. That is to say, every one of the partners who own it is responsible for all the debts of the concern, not only with the amount of money invested in the Baldwin Locomotive Works, not only with such surplus as he may have to his credit on the books, but also with every dollar which he possesses, every dollar which may be invested in his library, his home, his works of art, or any other luxuries of life with which men delight in surrounding themselves—all these are liable for the debts of the Baldwin Locomotive Works.

"Why, when all the rest of the world has gone to another business organization, have we adhered to this old-fashioned and practically obsolete business method? In the first place it gives a permanency in the conduct of the business. There are no stocks, no bonds, no securities of any kind. It is

therefore impossible for any silent partner of the concern to become dissatisfied with the management, or to be dazzled by the offer of a price for his securities which may seem to him very large, and to sell them out, so that by a number doing that at the same time the control or ownership of the organization can be swept away from those who are managing it.

"No matter how much those partners who are managing the business wish to retain it, the ownership is thus lost to them, and they find themselves either merged in another corporation in which they have only a trifling interest, or they find themselves out altogether. No such thing as that can happen in the old-fashioned partnership organization which we have. We own the business. Nobody else has any interest in it except those who are actively working day by day to promote its interest and increase it. We can go to bed at night and feel perfectly sure that we will wake up in the morning in just as full control of that business as we were at night when we left it, and that is something which is not always certain in the corporation.

"There is another fact which has had a very strong influence upon us also, and that is the fact that one of the traditions of the concern is that the managers of the business shall be those who have shown unusual ability and capacity in carrying on the business. Not a single man who is at present a partner in the Baldwin Locomotive Works has brought a cent into that concern. No one has bought an interest. Not one has contributed anything whatever to the capital of the business. We have all come in absolutely without resources, contributing nothing but our own ability, which ability has been earned in the service of that concern.

"The business organization is more simple and compact

than any business organization which I know of, conducting a business of equal magnitude. There are theoretically six partners. Actually at present three of those partners are seniors who do very little in the actual drudgery of the business. Theoretically we have one partner in charge of finance, one partner in charge of the business—that is the business of buying and selling—making contracts, managing the office (the thousand-and-one things necessary for the conduct of any business), one partner in charge of design, who is the chief engineer, and one partner in charge of the works, who is the general superintendent or the general manager. We have not any of those titles. As a matter of fact, there are no such offices. We are all partners on an equality, and we handle the business in each department simply on the basis of an agreement that shall be the business organization. As a firm we hold meetings (according to our co-partnership articles every week, but actually whenever we find it necessary to do so) at which all matters of broad business policy are discussed—matters of establishing new works, putting up new shops, or making large expenditures for tools. We agree upon such questions in firm meeting. We also agree on large policies in regard to making sales, rearrangements of expense, etc., but each of these four partners is absolute autocrat of the branch of the business he represents, because he knows all the time what the attitude of his partners is toward these matters. He does not have to consult them to decide whether it is necessary to make a contract or not. The thousand-and-one questions which are coming up daily in the administration of the business are settled instantly by the partner to whose province they belong, and if it is necessary to consult or get the opinion of one of the other partners, it can be done

in an instant. That is a great contrast to the corporate form of organization, in which the Board of Directors is supreme; in which things have to be put before the Board of Directors by the President, and in which the Secretary, Treasurer, and General Manager each has his little province, and they are all apt to be more or less jealous of each other, because I do not know of any place where the jealousies are apt to be keener than they are in business corporations, where the intrigue for promotion is apt to be very great.

"There are certain very serious disadvantages about the co-partnership. One is that a partner will go on accumulating a fortune, and, if he dies, instead of being an asset of the business that becomes a liability. That, however, can be safeguarded by an agreement, while all are living, that in case of death the interest which becomes due to the deceased partner's estate shall be drawn out so easily and slowly that there is no hardship to the survivors. The payment of that estate is no more onerous than the payment of dividends would be in a corporation, where you have to pay a dividend of five, six, or seven per cent. each year. That is the difficulty which most business men are afraid of in the co-partnership. They are also afraid of each other, because in the co-partnership the partner having power to make contracts may make an improvident contract—he may sign for something which would plunge his partners into debt. We have a way of getting over that, and that is by knowing thoroughly the men before they become partners. We have grown up together, we have labored together for many years, and we are in such close association that any surprise of that sort becomes practically an impossibility.

"I have referred already to the frequent conference of partners, and that is a valuable and vital principle. In

other words, we all know just what the other man thinks. We know what his sentiments are on every question which is liable to arise, but we carry the conference and acquaintance principle further.

"The heads of departments in the office—and there are some twenty-five or thirty of them—have periodical meetings at which any plan for the improvement of office methods can be formally proposed by any one, whether he is the head of a department or not; any criticism can be made, either of his fellow employees or of the partners themselves, if he chooses to. At one of these meetings it is competent for any one who is employed in the Baldwin Locomotive Works to tell me or any of my associates that we do not know how to handle the business, if he chooses to do so, and no offence will be taken at it, because we all meet on the level, and we are there for the express purpose of trying to devise ways and means of doing that business better.

"Now there is another kind of meeting—that is, of the foremen and clerks throughout the whole establishment. The office meetings are presided over by myself, who has charge of the business, and the meeting of shop clerks and foremen is presided over by Mr. Vauclain, who is general superintendent or manager of the works. There are certain things which those meetings are intended to accomplish. First of all, we lay down questions of policy among ourselves. In these meetings of our foremen—our best men—our chiefs upon whom we rely to carry out our policies—we can explain just what effects we want to produce, we can ask them for their suggestions as to how those effects can best be accomplished. We prefer to do this rather than to tell them how they shall do it. The giving of orders

is a very unusual and unpopular way with us. From the very top to the bottom of the Baldwin Locomotive Works there is practically no such thing as giving orders. The effort is made to bring out the best efforts of every man who is there, and it is for him to reason out how that work can best be done, and it is for him to suggest to his superior officer how he thinks the thing ought to be done, rather than to have the superior officer tell the subordinate how it should be done, making it mandatory upon him to do it that way.

"At these meetings, at which there are usually about 150 men, it is our business, first of all, to discuss the question as to how the product is to be gotten out. We will say we have an order for 500 locomotives for the Pennsylvania Railroad, and that the president wants them turned out at an impossible rate—at a rate which, with our facilities, would be an impossible thing. We get all our foremen and clerks together, and the announcement will be made that the Pennsylvania Railroad wants us to turn out for them twenty big freight locomotives a week. That was the demand which Mr. Cassatt made of us in the spring of 1905. He demanded that we should immediately start delivering twenty locomotives a week on a contract aggregating 500 locomotives. It seemed an impossibility, so all the clans were gotten together and the man whose facilities were weak was allowed to put some of that work into another shop, and after awhile this one would make a suggestion, and that one would make a suggestion, and this one would take on a little more work, and show where he was weak and could not take on work, until that question was solved, and during that year those locomotives poured out at the rate of twenty a week, and that was done while keeping up our contracts with others."

This description of these group meetings really gives us a picture of one of the finest civil service examinations the world has ever seen, and goes far to explain the success of this firm in getting efficient partners. What they want is men who can do things, and it is the great misfortune of practically all kinds of civil service examinations that a man can go through by written questions and answers, when he may be merely a learned ass, devoid of judgment, gumption, or common sense. He may have his head so crammed full of knowledge that he can answer written questions, but may be so handicapped in some aspect of his mentality or disposition that he has no efficiency above that of a routine clerk who can do some things by himself but cannot assist others in the management of even a small corner of a great works.

By this meeting, in which a concrete problem is brought before one hundred men, the man with the power to solve it comes forward with his plan and thereby becomes a marked man. If he can take his plan on and make good, he becomes a proved man. Thus the future partners show themselves.

"Another function of these meetings is to enable men to find fault with each other. In any large organization there are men who are dissatisfied with each other, who think that they could run a department a great deal better than the man who is running it, or who think that the man who is running that department is soldiering a little and is crowding his neighbors, or there may be personal questions. Men do not always like each other, you know, and when they dislike each other there is nothing they are so likely to do as to tell tales on each other. Sometimes a man, in good relations with his superintendent, gets his ear and

fills him full of stories about somebody else and undermines a man, and then feels that he is doing a great thing. That is a common thing, not only in Philadelphia, but everywhere. How do we manage that? In the first place, we listen to no stories from any man in regard to anybody else. The only time when a charge against another man will be listened to is in meeting, when not only that man is present, but all his fellows are also present. In other words, if Jones has a grievance against Brown, he must get up in foremen's meeting before the whole 150 men and say, 'Mr. Brown is doing so and so. It is not right and must be stopped.' Then Mr. Brown is there and can defend himself. Their associates know the whole story, and you can be pretty sure that Mr. Jones is absolutely certain that he has a good case against Mr. Brown, and you may be sure Mr. Brown knows that he is likely to have charges brought against him and is ready to defend himself, and you may be sure also that every one of those foremen rests perfectly secure, because he knows that no one can come and undermine any of the men in the opinion of their employers. He knows this because he knows that it is impossible for him to undermine the reputation of any one else. That has cleared the atmosphere of anything like intrigue. It has made the place wholesome, and has made the place one where every man has only one motive, and that is to get out the best product at the least cost, and where each man strives to make the very best record for the firm for which he works.

"I have told you how we have all come into the firm as beginners. I want to tell you something about what we do with young men there. We very rarely take a man much over twenty years of age. We catch them young and train

them. They are not there very long before they get a new way of walking, and a new way of working, and a new way of thinking, all of which combined we call the Baldwin spirit. These young fellows have a club which they call the Locomotive Club. They meet once a month to discuss ways and means, first, of better understanding the working of a locomotive, and, second, to consider methods which are proposed for improving locomotives; also to consider among themselves (without any interference from superiors) how they can better do the business which they have to do. This locomotive club is made up not alone of technical men, but the office, and the drawing-room, and the apprentices are all members of that club, and I don't know when I have had more pleasure than to talk to those fellows, and feel that they are the ones who are going to conduct that business after I have passed away.

"Now where are we going to get these young men? We need lots of them. About five years ago we recognized the fact that we could not rely upon getting young men out of the street; we could not rely on any Tom, Dick, or Harry who might come in and ask for a job. We also recognized the fact that the division of labor was wiping out the old race of all-around machinists and business men; that a boy out of school would get a job at a lathe or drill, and he would work at that, on some special process, at perhaps seven or eight dollars a week, until he got to be twenty-one, twenty-two, or twenty-three years of age; and then he would get tired, and it was to the interest of the employer not to pay him any more, but to discharge him and hire some other boy of sixteen or seventeen, because the new boy would do it just as well as the old, and the result of that system, which is very widespread, is that there are thousands of

worked-out, tired fellows who have learned a particular process and nothing else, who are good only for that process, and who, in spite of all they can do, can never get more than nine or ten dollars a week for working at that process. They have the laudable ambitions which every man should have—to marry and have a family, and to see his children growing up to be good citizens—and he cannot do it, because, under the system of division of labor, there is no future for him. Mr. Vauclain, in considering how he could bring about an improvement in that condition of affairs, after consulting with all of us (we gave a great deal of thought to it and had it under consideration for two years), decided boldly to employ a large corps of young men, and then to train them up so that as we got tired ourselves they could take up this load and carry it for us, and they will be the leading men when we are ready to step off. The plan is this: we take apprentices of three classes."

They are divided into classes because of variations in age and educational experience. One for boys from the grammar school, one for young men who have graduated from college in the general courses, and one for graduates of engineering courses. Each has a definite amount of time to work at each of many types of work within the plant, so that he may get an acquaintance with the work somewhat corresponding to the working knowledge which the apprentice got in the old domestic system when he worked with the master. Mr. Johnson's description of the plight of the machine worker of the present period is a statement of fact that should alarm any well wisher of man or industry.

"There (referring to the apprentices) is the reservoir that we are drawing from, and I wish to emphasize one thought, and that is, that, however much the young man himself desires promotion, it is not half as important to him to be promoted as it is to his employer to find the right fellow to promote. As an employer I can say that I have walked up and down my office, and have looked into the faces of a hundred men, trying to perceive there the qualities necessary for advancing them. It is in order to increase the number of men from whom we can make that selection that we have introduced that system. It is more important for the employer to promote his employee than it is for the employee to be promoted, in the proportion that the personal interests of the employee bear to the vast interests which the employer has to care for.

"I recall the president of a large car works, a man seventy-two years of age. He took me by the arm one time and said, 'Johnson, how do you get all these bright fellows about you? I have been hunting for thirty years and have not been able to find a young man worth anything. They are not worth mentioning.' I said, 'That is because you don't think they are worth their salt. If you would let them discharge the responsibility which you insist upon discharging, you would find them worth their salt and a great deal more.' That is the principle we are compelled to adopt—not necessarily because we feel that it is the wisest and best business, but because we are lazy and wish to find others to share the responsibility. When I am over sixty I want to go to Europe and go through the art galleries, and all that sort of thing, and come back and perhaps stay eight or nine months a year, and see that

somebody else is doing that work better than I ever did it. That is the principle that pervades the whole place.

"I never knew any one to be criticised for exceeding his authority. We want them to exceed their authority. The more a fellow exceeds his authority in the right way, and wisely discharges the duties which he sees that he can discharge, the more we think of him, and the larger his increase will be at the first of the next year. There are large opportunities for young men there. We not only have to fill all the places as the older men become superannuated and retire, but we have to fill places which arise day by day out of the phenomenal growth of this business."

The Search for Responsibility.—This statement by the captain of industry of the search for men may seem a little difficult of belief by the average young man who occupies his first position in a big enterprise. Of course, there are places where it is not true, but my own acquaintance with people at work and my acquaintance with different parts of the United States lead me to believe that in the main it is true. There are two types of responsibility: one which can take orders from somebody and execute them, and one which can see opportunity and grasp it. I know that the search of people with enterprise and capital for men who can take charge and carry out their plans is astonishingly widespread and often fruitless. The fact is that the man who can manage other men is unusual, and the positions of responsibility that do not require some management of other people are very few. This ability is partly a gift and partly acquired, and once it is shown, there is little doubt that there is a surprising number of places where it can become effective, chiefly because most people do not

have it. Most people want somebody to take the responsibility and tell them what to do. Then they will do it, but they should not expect large reward.

The second type of responsibility, that which can see openings and grasp them, is also strangely lacking, as the examination of industrial conditions, both agricultural and manufacturing, in many parts of this country proves. In large sections of the East, for example, the population welters in poverty because there is not a man in a thousand who can develop an industry in the midst of a locality with abundant labor resources, good raw material, and fair amounts of capital to be had by the man who can command confidence and show ability.

In this matter of forming partnerships, Mr. Johnson has shown how his firm has so successfully picked out the men who can do things. It is to be noted that these men had years of experience before they attempted their partnerships. The work had become known to them and they had become known to each other, thoroughly known. Ordinarily, when two men make a partnership, they form it on a rather limited basis of acquaintance. They may know each other well, as friends, but have had small opportunity perhaps to get acquainted with each other in the particular line of business performances, as was the case in the Baldwin Locomotive Works, where year after year men had watched each other meet problem and meet situations and solve them. The lack of such knowledge is often the great weakness of partnerships. Partnership and friendship are different things, as many a man has found out to his sorrow. The partnership shows its real success on the profit and loss account, not in the pleasure of association.

The discussion of the partnership as given by Mr. Johnson showed its two weak points from the standpoint of average business. First, it is difficult to make a partnership sufficiently large. Second, the personal liability of all members is too grave a risk for most people to face, and so they shelter behind the limited liability of the corporation, which is more and more coming to be the dominant unit for conduct of business in America as well as in the more industrial foreign countries.

CHAPTER IV

TYPES OF ORGANIZATION—THE CORPORATION AND ITS POWERS

TO AVOID the responsibility of partnership various legal limitations of liability have been devised. The most perfect of these is the corporation, in which those who participate are liable only for what they put into the concern, not for all they own. This device makes it possible for many to enter and, by the combination of many small shares, to get the great amount necessary to build a railroad, for instance. A modern railroad is so big that, despite its monopoly advantages, it is impossible to conceive of an old-fashioned partnership raising the capital to run it.

The corporation has become so necessary and so common in modern industry and trade that we have by law made it very easy to start new ones.

The starting of a corporation is provided for more or less automatically by law, just as we provide for the purchase and sale of land, the consummation of marriages, etc. For these purposes there exist general laws, and offices to execute the necessary papers. It takes but little longer to start a corporation in most state capitals than it does to transfer a piece of real estate, and the process is essentially similar, consisting merely of taking out the descriptive papers, the deed in the case of real estate, the charter in the case of corporations, and entering the record in the proper books. In most states three persons can in a few hours and for the payment of a few dollars organize a corporation which has astonishing powers. Laws regulating the foundation of corporations are intended to make it easy to

go into most classes of business. There are, however, certain limitations to the powers of these corporations, that are chartered under the general acts of incorporation. Some powers are too perilous for the state to permit persons to get under any general law.

Some corporations, such as the railroads, trolley lines, canals, telephone companies, and power transmission lines, require the power of eminent domain. These enterprises require definite strips of land going from one place to another. They can be made efficient only by having the state's power of compulsory purchase whereby the individual in secure possession of his home is dispossessed to make way for the improvements. He gets payment, it is true, a fair price, but none the less he is forcibly dispossessed. Manifestly, if any three men could run up to the state capital and get such power we would be likely to have great abuse, spite work, and even blackmail growing out of it. For this reason the granting of powers of eminent domain to corporations is in most cases given only by special acts of the legislature.

There is similar danger to the community and therefore similar need of greater control existing in connection with corporations dealing with money and credit. Corporations carrying on such business as banking, the issuance of credit instruments, the insuring of lives, and similar functions have serious possibilities of menacing the welfare of the community unless closely limited in their authority.

The list of powers which the general act of corporations permits in a state like New Jersey is, however, astonishing in its completeness. Thus a copy of the charter of the Hamburg-American Line Terminal and Navigation Company, as it appears on the books of the secretary of state,

Trenton, N. J., shows that a group of Germans, headed by Mr. Albert Ballin, director-general of the Hamburg-American Company, and ten other directors, have formed a corporation which has several pages of powers verbosely stated after the manner of lawyers. In brief they are:

1. To get necessary facilities and carry on the business of loading and unloading ships at any ports throughout the world.
2. To transport passengers and freight by water anywhere.
3. To register ships under any government (this would permit them with German capital and German-owned ships registered under American flags to engage in American coast trade and thus gather together traffic for the trans-atlantic liners).
4. To buy good-will and property of any sort.
5. To do any and every thing within their powers exactly as an individual would.
6. To conduct business and convey real estate in the United States and foreign countries.
7. To manufacture goods and own real estate.
8. To secure patents, trade-marks, and, in operating the same, to carry on any business that they deemed necessary, including mining.
9. To hold and vote the stock and bonds of other corporations (this, making them a holding corporation, would enable them to buy any and every corporation in the United States if they could secure stock in the market).
10. To guarantee the payment of dividends.

11. To enter into contracts with individuals and governments.
12. To carry on any other business that the laws of New Jersey might permit, provided it appeared to the interest of the corporation.

Lastly, "it is hereby expressly provided and declared to be intended that the foregoing enumeration of specific powers and objects shall not be held or taken to in any wise limit or restrict the objects or powers of the corporation, but the objects and powers as specified shall be independent objects and powers."

State records showed in the annual report no annual meeting of the stockholders had been held, and of the $500,000 of authorized capital stock $1100 had been paid in. This showed that the corporation really was merely a dormant grant of powers which a group of capitalists had seen it wise to secure during a period of very favorable legislation and which they were keeping technically alive until they might want it. Under its powers they could engage in practically any kind of producing, carrying, or mercantile business, own any corporation having stock that was for sale, and become, if their finance and astuteness permitted, one of the greatest trusts ever seen.

There is nothing unusual about this grant of powers. It is merely typical of what any three persons could have granted to them by spending a few hours and paying a few dollars in Trenton. Most other states are generous enough for all ordinary business.

Manifestly the corporate form of conduct of business is not hampered by limitations of powers. It is true that

corporations are failing by the dozens every week, but it is because of the difficulty of the managerial problem, the common-sense problem, the difficulties in operating the powers which are so easily obtained.

Since the average individual who gets into business for himself, or almost for himself, is likely to do it as a member of a small corporation, the pitfalls causing such widespread destruction to this form of effort are worthy of careful examination. A house, a building, or a bridge fails through the violation of certain fairly definite engineering rules. Similarly the corporation that fails does so because of the violation of some rather simple rules. Unfortunately they cannot be so definite as are those which explain the shortcomings of bridges and buildings, because bridges and buildings are made of definite specific material, substances of fairly uniform consistency, whereas the failures and successes of corporations are made out of the operations of human nature and human judgment, which tend to be ever varying and ever complex. Nevertheless, a dozen or so rather simple causes will explain the vast proportion of corporation failures. As most of these causes are visible to examination, their study has the possibility of being profitable.

CHAPTER V

The Management of the Industrial Corporation

Success is very desirable, but the study of failure is often more instructive than the study of success, and I therefore present an analysis of the causes of the failure of corporations.

1. **Going Into Business on a Large Scale.**—There is a great contrast to be made between *going* into business and *growing* into business.

Experience, after all, is the great teacher. Our imagination is so limited that, despite the most careful theoretical preparation and study of the problem in the abstract, we find it practically impossible actually to foresee the occurrences that will happen in this exceedingly complex world of business. This may sound like the condemnation of schools and study. Not so. It is, on the other hand, a very definite statement of their limitations. Schools and study undoubtedly enable a man to profit more quickly by experience and thereby enable him to reach a higher goal in a shorter time.

If a man or group of men start a new business on a large scale, the process of learning by experience involves a series of losses and lessons, and each unit of loss is so large that financial trouble is likely to ensue. Wrecks of corporations of this type may be found in countless numbers throughout the country. If a man starts in, on the other hand, in a small way, his little failures may be properly classed as laboratory material. One after another he profits by them, and gradually gets that store of working know-

ledge which enables him to handle large enterprises. This fact is the real basis of the old, well-known conflict between the rule-of-thumb, successful, business man and those who speak of the value of schools, colleges, and education. The rule-of-thumb business man says the college is not practical, and in part he is right. In fact, both parties are right, and what we need is a combination of the elements of theory and actual experience in the man who is to attempt industrial management on any large scale.

2. **Bad Location.**—Many enterprises are doomed to failure because of some fatal factor in their location. Any and all kinds of mistakes of this sort are to be met with, such as the establishement of a canning factory in a place where the soil does not permit the particular produce to be grown, or where, soil permitting, the labor conditions do not favor its production. I know of a large factory that was built outside a city with the expectation that there would be an abundance of girls to work in it, but it was a mile from a suburban railroad station. No labor ever came, the factory never started, and it has stood idle for years. Another form of bad location is the starting of a plant which may be in a good district, a good general location, but in some immediate location which is cramped or difficult of access to transportation of heavy raw materials and products.

Perhaps the greatest single factor in promoting the bad location of producing enterprises is local patriotism. Every city seems to have the desire, often an irrational desire, to grow larger. The people of every small town want to see it become a city. Into this psychological background some enthusiastic citizen or some promoter projects the idea that "our town needs such and such a factory," and the

people are persuaded on that basis to subscribe the capital. This emphasis upon the locality and its needs for more business, causes people to fail to make careful examination of the actual fitness of the location for the particular enterprise. The appeal is really a combination of philanthropy and business, though the results are expected to be purely in the business field. This confusion of philanthropy with business is bad. If the town needs a public library or hospital, the appeal is purely philanthropic. People are able to give their money with the full knowledge that they will never get it back. It renders its successful service by supporting a non-paying library or hospital, but the money that is subscribed to start the new factory can attain its success only if the factory makes dividends. Unfortunately the local patriotism that causes subscriptions of stock has nothing to do with the making of dividends, and indeed tends to destroy, for the reason that this same local patriotism inclines to make the town look a bit too favorably upon its own sons for the operation of an enterprise of which they may know but little. Because of these factors, plants are placed in all kinds of wrong places and managed by men who do not know. A large proportion of such enterprises are added to the list of failures.

3. **Poor Accounting.**—The ignorance which the operators of plants possess concerning their business is at times almost unbelievable to those who have knowledge of cost-keeping and modern systems of accounts. In hundreds of cases it is the receiver who first establishes any adequate system of accounting. The physician who tries to diagnose the case of a sick patient uses the clinical thermometer, counts the pulse, takes the blood test, and makes other examinations. For the competent receiver as for the competent

manager all these tests for the condition of the corporation are rendered by the accounts. In fact, they tell more about the corporation than the physician can usually tell about the patient, sick or well. I recently heard of the case of a corporation manufacturing ten or a dozen different food products. They had salesmen going over two or three of the Western States, but somehow they did not make money. They never knew why until the receiver established a cost system and thereby worked out the cost per unit of each of the various lines of goods. It was then discovered that three of the articles, of which the management had been most proud and of which they had pushed sales the hardest, were being produced daily at a loss. This fact discovered, the necessary common-sense readjustments were made and profits ensued. I know of another case where a large enterprise doing a combination of manufacturing, jobbing, and retailing had really about five businesses, or certainly five departments, and the managers of the enterprise knew nothing whatever about the profit or loss or cost of doing business in any one department. Finally they got into bankruptcy and a trustee was appointed. He made new systems of accounting. The firm is again going forward under the same management, but is making money. The manager now knows more about the conditions of profit and loss at the end of every week than in the losing period he knew at the end of a year or eighteen months. If trouble arises, he finds it quickly; if profits are being made he can avail himself of the advantage of knowing how they came.

The speed with which this ignorance of cost-keeping makes for ruin depends somewhat on the frequency of turnover. In some lines of business the total capital of the

enterprise is not equalled by the total sales for several years. This is especially true of agriculture. On the other hand, certain kinds of manufacturing turn over all the working capital every two or three weeks, so that losses, if occurring, run quickly into ruin.

Dividends from Depreciation Fund.—Another form of fatality from bad accounting is that in which over-greedy stockholders exert pressure upon weak-kneed or ignorant directors and clamor for dividends. I know of a case of this sort in which money in sight was paid out the first year, the second year, and the third year in dividends. The matter of repairs of machinery was ill attended to, and there was no provision for a sinking fund or depreciation account for machinery replacement. The fourth year the bad condition of the machinery manifested itself in urgent demands for heavy replacements. As the firm was already using about all the credit available for other purposes, the money was not in sight either through cash reserves or available credit, and failure promptly resulted.

Poor Collections.—A slightly allied trouble, although it is scarcely correct to say it is bad accounting, is that which exists when the management is lax about making its collections. Many a firm is in fairly good condition on the books, but has an unduly large amount of money owing it, which would not be the case with a more pushing management.

4. Bad Labor Management.—This problem is so widely known that no discussion is needed to make its importance manifest, and it is so great that space does not here permit its presentation. Whole chapters are devoted to this subject later on in this book.

5. Confusion of Technical Knowledge with Business Judgment.—I was once solicited to take stock in a canning

company which was being started in a country town. "Who will manage your plant?" I asked the solicitor, who was, by the way, a shrewd business man in at least two lines. "Oh," he answered confidently, "we can easily get a good processer. He can make good canned tomatoes and canned corn. It's no trouble to sell them." As a matter of fact, the enterprise survived two years and was practically a complete loss. The gentleman who placed his dependence upon the "good processer" had entirely overlooked the great fact that the management of a productive enterprise is far more than a technical question. In fact, good processers *are* abundant. It is very little trouble to get a good tomato canner, a good flour miller, a good baker, a good candy-maker, a good machinist, a good stationary engineer, a good weaver, a good spinner, or a good analytical chemist or a good accountant. It was one of the intellectual shocks of my young manhood to discover that an analytical chemist could often get only $50 a month. I had long looked with awe upon the accurate percentage and detailed reports of the analytical chemist. This water contains 2.341 grains of such and such a substance per gallon. I wondered at the marvellous man who could get out such fine results, and to learn that he at times gets but $50 a month was a shock. The explanation is this: the chemical analysis of ordinary specimens is a technical process of a perfectly definite character. If a work is definite and therefore capable of being reduced to clear-cut instructions, the pay that it commands is not likely to be high, even though the work itself be complicated. It requires good memory and pains-taking obedience to instructions. Many persons have these qualities. The scarce attribute is judgment, that indefinable quality capable of meeting a new situation and handling

A cool analysis of the history of such an enterprise in a town that we do not know causes us to stand aghast at the follies that successful men will perform in this line.

7. **Undercapitalization.**—Every business has within certain limits the size of plant which is best fitted for normal and profitable production. If the plant is smaller, it is almost certainly inefficient, and if larger, it may be. Thus it takes at least a million dollars to build a blast furnace. A man or group of men with $500,000 attempting to make pig iron would be starting a manifestly undercapitalized industry. Many enterprises fail because of a situation of this kind. The progress toward failure is usually the same in all cases. Production costs per unit are greater than in properly equipped establishments; extensive borrowing must be resorted to in normal times; a period of depression occurs, and the inability to secure further loans soon brings the luckless enterprise into hopeless bankruptcy.

8. **Overdevelopment.**—Closely allied with No. 7 is overdevelopment or lop-sided development. A corporation with an abundance of capital to conduct business normally in a certain location produces a lop-sided concern. I recall the case of a food-producing plant that had to have heavy proportions of working capital, but which, owing to the inducements of a promoter, put nineteen twenty-fifths of its money into a plant which was unreasonably large for the location as well as for the capital of the company. This matter of the symmetry of an enterprise is really an important matter. If we should take the arms and legs of a five-foot man and a six-foot man and mix them up, we would have a very grotesque creature who would go hobbling along with one leg several inches shorter than the other. The short legs on the short man and the long legs on the

tall man perform their function admirably, but they do not mix well. Every corporation must really have a number of parts. It has a building, it has equipment, it has raw materials, it has finished products, it has cash reserve—or should have—and it has various functions of management. Just how shall the funds be divided to meet these various demands? To determine this really requires a high degree of judgment. Without it, lop-sided or top-heavy fatalities often occur.

9. **Nepotism.**—From the Latin word for nephews. Beware of the nephews of the successful! They are nice young men, it is true, and being of the blood of the successful they have, upon the average, a better chance to inherit the qualities for success than does the average man. The trouble is that potential qualities for success must, we know, be developed by education and experience. The latter they often fail to get. Merely because they are these fortunate nephews they do not get the knocks that give the experience necessary to develop their powers. The old saying that "Blood is thicker than water" is really a potent destroyer of good business. It is a fact, blood *is* thicker than water. We love our relatives, we like our friends, and we are going to do the best we can for all of them, with the result that we put men in positions because they are our friends or our relatives rather than because they are fitted by nature or experience to assume responsibilities in the best possible way. Another name for nepotism is "pull." It puts the right man in the wrong place, where he can wreck enterprises. It also discourages other young men because they see that a rival has an opportunity merely because of relationship, not because of merit. This evil is particularly strong in old enterprises that run through the second and

third generations. A man starts a concern, hands it down to two or three sons who vary in ability, and by the time their sons have got good positions all the way through the concern it is well fixed on the high road to ruin. Almost any person of wide observation can name a few examples in point.

10. **Graft.**—Any one who thinks that graft is purely a political institution is making a grave error. It has merely crept into politics from business. The corporation is a peculiarly favorable form of business for the practice of graft. One corporation buys from another corporation or sells to another corporation which is composed of the members of the parent corporation. Railroads have been built by construction companies which were operated by the directors of the railways. They buy their supplies from supply companies which are again composed of the same directors. It is probably not going too far to say that many of the great fortunes of America have come into being by such dealings. Indeed, it has gone so far as to be an important part of the high cost of living. While it is probably worse in the large corporations than in the small, it is a widespread factor.

Success.—Opposite each of these elements of failure is an element of success. The well-managed corporation has enough capital, is conservatively financed, is symmetrically proportioned in its arrangements, has managers who have had experience in their work, who operate the business honestly, and can at frequent intervals know the exact condition of their affairs.

Two or three examples of successful corporations will show how some of the snags have been avoided and how men have availed themselves of the great fundamental fact that experience is the teacher.

We see the name John P. Jones Manufacturing Company. It means that John P. conducted the business himself, probably began in a small way, learned as he went along until his success was so great that the neighbors were glad to subscribe money to enable him to conduct it in a larger way. Then he incorporated. His corporation is apt to succeed. Its trouble comes upon the final passing of the original John P. Who shall succeed him? This is the great difficulty of all corporations that have been through a period of success. This situation cannot be met by any rule except one, and that is close scrutiny of the new management. If the new management comes in inexperienced, a grave risk is being run. In any case there should be such forms of accounting that mistakes are found quickly rather than after the concern has been hopelessly deranged by going for a long time unchecked in a course whose business results are unknown. The original Jones may have been able to run the business with poor accounting. With the same system of accounts the new man may be in bankruptcy before he knows it. Careful comparative accounts giving quick knowledge of conditions are fundamental for the success of the small industrial corporation which is changing management, as from time to time they all must do.

I know of a small corporation started by two men. One was a book salesman out of a position. The other was a carpet weaver who knew how to make a good rug. The weaver thought he could run a loom himself most of the time and superintend three others. The bookseller thought he could sell a few rugs if he brushed up on carpet lines. Between them they had a few thousand dollars. They started the business, but did not put much of their capital

into plant and equipment. They rented space with power, they rented looms. They let others hold the bags of capital. The only new thing they took up, therefore, was the purchase of the yarn, which is really very simple. They sold rugs faster than they could make them. Gradually the business grew. They rented more space. The weaver hired more weavers and became practically working foreman. Both men are now in comfortable means.

One of the best examples of the growth of an industrial corporation from nothing but the know-how is afforded by a tanning company. A man of fifty and his three sons were expert tanners, knowing all the processes for making enamelled kid. They went to a Boston leather jobbing house, told them they contemplated starting a tannery, and, as they were rather short on working capital, they would be glad to give the Boston house an exclusive ten-year contract to sell all their product if the firm would furnish them the hides and make a slight advance for the pay-roll for a few months. This the Boston firm gladly did. The quartette then started out to find a town in which to build their plant. The first and second towns would not hear them. The third was a sleepy little country town with no industry of any importance and a population of about 2500. The tanners admitted later that they reached this town with $18 cash. They said they were going to start a tannery, but would not do so unless the town furnished free land to build on and subscribed for some of the stock. This the town agreed to do, and gave them twelve acres over by the railroad, and finally bought $2150 worth of stock in the company. With this the plant was partly constructed. When the money was gone, a first mortgage was placed upon the whole thing for enough money to

finish a small plant. Then a shipment of hides came and a little cash from the Boston firm for pay-rolls, and the leather making started. Chemicals were bought on time. The first sale of hides was made, more cash came in, and the circle of business was running.

I want to emphasize the fact that these men started nothing new for themselves. The purchase of raw materials and the sale of products were the big new things in that enterprise. This they left in the hands of the Boston company. They were expert makers of leather, which they continued to be. They taught others, and in a few years all of them were men of wealth.

CHAPTER VI

The Advantages of Large-scale Production

The words "large-scale production" have been dinned into our ears until we may feel that they are part of the air we breathe. It is, of course, well known that it is cheaper to produce things in a large way than in a small way, but nevertheless that fact becomes more usable when we understand just how it happens.

A. **Equipment.**—If we will examine fields of different size it will become evident that the larger the field the less fence per acre it takes to enclose it.

Table I

Decrease of Periphery as Area Increases

Dimensions of tract	Area of tract	Amount of fence for tract	Amount of fence per acre
35 yards square	¼ acre	140 yards	560 yards
70 x 17½ yards	¼ acre	175 yards	700 yards
70 yards	1 acre	280 yards	280 yards
140 yards	4 acres	560 yards	140 yards
280 yards	16 acres	1160 yards	70 yards
440 yards (¼ mile square)	40 acres	1 mile	44 yards
880 yards (½ mile square)	160 acres	2 miles	22 yards
1760 yards (1 mile square)	640 acres	4 miles	11 yards
3520 yards (2 miles square)	2560 acres	8 miles	5½ yards

Thus the acre in the cattle ranch has less than one per cent as much fence as the acre in the town lot.

This table happens to refer to tracts of land merely because they are one of the most visible forms by which we can appreciate this point. It holds just as true for walls and floor space of rooms, for the outsides of houses, for many, and in fact almost all, kinds of rectangular equipment. We

thus see the economy in the factory which permits no partitions and has a single loom or operating room which covers a whole floor, perhaps an entire block in area.

Circular equipment shows practically the same thing with regard to cheapness of constructing large units.

TABLE II

Radius of circle	Area circle $=\pi R^2$	Circumference $=\pi D$	Ratio of square units of area to linear outside unit.
½	3.1416 × ¼	3.1416 × 1	1 : 4
1	3.1416 × 1	3.1416 × 2	1 : 2
2	3.1416 × 4	3.1416 × 4	1 : 1
4	3.1416 × 16	3.1416 × 8	1 : 1/2
10	3.1416 × 100	3.1416 × 20	1 : 1/5

Thus if we are considering pipe we must realize that the part we use is the area of a circle and the part we buy is its circumference. Granting a similar thickness of material, the column of ratios of square units of area of the circle to linear units of its circumference shows us that the inch pipe, radius ½-inch, is twenty times as costly per unit of working performance as is the 20-inch pipe, radius ten.

We see these facts in cumulative force, however, when we consider the contents of cubes. Consider for a moment a cold-storage plant, which has as a very important element of expense entering into its construction the insulation of the outside walls.

TABLE III

CONTENTS OF CUBES

Length of side of cube	Area of one side	Outside surface of the cube	Contents of the cube	Cubic contents per unit of surface
10	100	6,000	1,000	1⅔ : 1
40	1,600	9,600	64,000	6⅔ : 1
100	10,000	60,000	1,000,000	16⅔ : 1

It is true that cold-storage plants that are 100 feet square and 100 feet high are unusual, but persons familiar with this type of plant at once recall that they are usually large blockish buildings, many stories in height, taking great advantage of the facts above mentioned. Furthermore, a cold-storage plant cannot be built and operated unless it attains very considerable size, because of the economies which result from the operation of large-scale equipment.

The elements shown in examining these three tables above cover practically all the elements entering into industrial equipment. Occasionally we have an ellipse or some curve that is not a part of a circle, but 99.5 per cent. of all industrial equipment avails itself of the circular or rectangular form. Examination of these three tables shows at once why the bins and barns for the storage of raw material, the cases and packages for shipment, tanks, moving vans, freight cars, ships, have all within the last few decades increased tremendously in size and thereby increased in efficiency.

B. Operation.—The large-scale equipment shows similar advantages when we come to consider its operation. It takes one engineer for a locomotive, whether it has the capacity of 20 horse-power for a little yard engine or 1000 horse-power for a heavy modern freight hauler. The big steamship with 40,000 tons requires one pilot at a time and the same number of engineers in charge of its mighty engines as a ship that is but a fraction of its size. An examination of the labor costs of a blast furnace shows how this element operates in manufacturing.

DETAILED ANALYSIS OF LABOR COST AT AN AMERICAN BLAST FURNACE FOR A MONTH

Occupation		Occupation	
Carpenter	$0.0171	Ore breakers	$0.0171
Carpenter's helper	0063	Laborers (S. H.)	0243
Machinist	0254	Cindermen	0171
Machinist's helper	0128	Trackmen	0229
Blacksmith	0132	Laborers (C. Y.)	0256
Blacksmith's helper	0079	Iron loaders	0464
Oilman	0071	Laborers (I. Y.)	0092
Foreman	0751	Boss unloader	0092
Engineers (blowing)	0212	Coke unloaders	0413
Engineers (locomotive)	0212	Coal unloaders	0046
Switchman	0171	Ore unloaders	0096
Water tenders	0199	Stone and marble unloaders,	0004
Fireman	0172	Trestle	
Stoveman	0200	Crushermen	0402
Keepers	0224	Horse hire	0211
Helpers, first	0199	Horse hire helper	0066
Helpers, second	0384	Moulder	0108
Iron carriers	0992	Moving chills	0202
Scrappers	0178	Loading chills	0025
Laborers (C. H.)	0403	Oiling coal	0071
Top fillers	0199	Repairing cars	0040
Top fillers' helpers	0192	Digging loam	0007
Scalemen	0192	Cleaning up	0119
Fillers	1069	Cleaning boilers	0021
Boss (S. H.)	0101	Total	$1.0492

The cost of this blast furnace has been very finely subdivided and shows this great point—in the operation of equipment much of the cost, at times most of the cost, bears very little relation to the size of the unit. The point is that the operator is operating a unit and might as well operate a big one as a little one. Thus the carpenter and carpenter's helper, the machinist and machinist's helper, the blacksmith and his helper, were going through the necessary motions of patching and repairing a machine. In many cases they could have done it about as well with a machine of twice or quadruple the capacity as with a small one.

There is really very little difference in the amount of ground to be covered by the actual equipment of a blast furnace of 200 tons capacity and by that of one of 600 tons capacity. This particular furnace had an output of about 180 tons a day, or one-fourth the maximum. The oilman was employed to see that certain bearings were oiled. What difference did it make to him whether the bearing was for a shaft 3 inches in diameter or one that was 6 inches, having several times the power possibilities? He could just as well care for a big furnace as a little one, and probably could have cared for two. The foreman might have received somewhat larger pay in a larger furnace, but certainly it would not have been four-fold the pay at the small one. The blowing engineer who ran the engines that operated the air blast was employed, as are all stationary engineers, in seeing that the machine does not get hot or out of order and that it is properly oiled, a task which a man can render for an engine of 1000 horse-power or 50 horse-power with equal ease. The same thing is true of the locomotive engineer, who pulls freight cars around the yard, and the switchman. The water tender, like the oilman, inspects for the operation of a certain type of machinery; namely, the condition of the water in the pipes which run through the jacket of the furnace to keep it from getting hot and melting down. The stoveman renders the same type of service by keeping the air blast properly shifted from the stoves to the furnace and by attending to temperature control. The keeper is responsible for the conditions of the iron when it is drawn.

Only a small proportion of the men about this plant show an effort that was in proportion to its output. We find the total cost of over $1 per ton is met by an expendi-

ture of 40 cents in the largest type of furnace. This figure is not an exact measure of labor efficiency. A part of this economy is due to the fact that some of the labor in the larger furnace can be replaced by machinery, an economy which becomes possible only with the increase in size of the equipment. In the main, however, the lesson of reduced cost for the operation of large-scale equipment is of almost universal application.

The really important question is, How shall this principle be utilized?

CHAPTER VII

Overhead Charge as a Management Factor

Occasionally some manufacturer will exclaim with emphasis, "It's all in the overhead charge," referring thereby to the great importance of this item of cost as a factor in high or low cost of production. This factor is to be found in merchandising as certainly as in manufacturing or agricultural production. Its essence is the full utilization of the equipment so that a small equipment may make a large output. The attainment of this end produces at times some apparently contradictory situations.

Some years ago I attended a bargain sale at John Wanamaker's famous department store in Philadelphia. A counter in the middle aisle near the front door was piled high with shirts being sold for 50 cents each, when their previous price had been $1 and $1.50. It was in late summer, practically at the end of the season for goods of this class. After some waiting and scrambling, I got through the crowd of bargain hunters, secured a shirt for 50 cents, which I found, upon later examination, to be of the wrong size. I got it on Saturday afternoon, and Monday morning early I returned to exchange it. I went back to the same counter, and, behold, it was full of socks, and another crowd scrambled for socks. I inquired of the floor walker about the shirts. "Oh," he said, "they are around there behind the stairs at the remnant counter." There I exchanged it for one of the right size and got in addition two collars and a pair of cuffs, of which the usual retail price had previously been 50 cents. Why did John Wanamaker sell on Saturday

$1.50 shirts for 50 cents and on Monday throw in a half dollar's worth of collars and cuffs? His success proves that he is not a lunatic, but where does the profit arise in that transaction?

The point was that the shirt business was done. Probably 95 per cent. of the stock had been sold, and what was left was broken sizes, odds and ends. What should he do with them? They encumbered his counters; the demand was so low they could not have been sold at or even slightly below market price until next year. Should he keep them over? If he had, the capital cost would have been increased as the ratio of ten weeks to fifty weeks. The carrying over of odds and ends of stock should, of course, be a general policy if adopted, and it would have required a vast amount of space and an almost inconceivable system of records to keep the stuff straight. In fact, it would almost require another store building as big as the one he had. He had sold 95 per cent., make a reasonable profit, and the rest was to be got rid of as quickly as possible so that a new normal sale could be begun, permitting rapid turn-over of capital and full utilization of material. It was as though he were carting the remnants off to the dump, and that kind of sales in some parts of the world is called "dumping." The retail merchant avoids spoiling his normal market by dumping these remnants at the end of the season. The next season they start in at the normal high price again.

This policy has made much acrimonious discussion when it has appeared in international trade.

We can perhaps see its working out quite clearly in noticing the cost of using certain equipment: for example, the farmer's reaper and the farmer's wagon.

YEAR COST OF MAINTENANCE

	Manure Spreader	Reaper	Wagon
Interest on $100, 6 per cent	$ 6.00	$ 6.00	$ 6.00
Depreciation, 10 per cent	10.00	10.00	10.00
Repairs	3.00	3.00	10.00
Roof over it, at least	5.00	5.00	6.00
	$24.00	$24.00	$32.00

Cost per day:

To owner using manure spreader or reaper 12 days	$ 2.00 per day
With one neighbor using, 6 days at $1	1.50 per day
With two neighbors using, 6 days at $1	1.00 per day
With four neighbors owner's use costs nothing	
With no income from neighbors, owner's use of wagon 6 days	$ 4.00 per day
2 days	12.00 per day
100 days	.32 per day
200 days	.16 per day

It is thus plain that the costs per year are largely fixed charges, and that the amount of use per year causes a variation in the cost of a day's service. Thus the reaper costs $4 a day when used six days, the manure spreader about $2 when used twelve days. In this connection I found a farmer hiring his neighbor's manure spreader for $1 a day, and repairing any breakages that may occur, yet each regards the operation as profitable, and an examination of the cost factors seemed to show that they were both right.

In connection with this farm equipment cost, the figures of team cost for a city factory were interesting. Six horses were used by the firm, and the cost per horse per year was approximately as follows:

Food	$120 per year
Depreciation	30
Interest	15
Shoes	24
Veterinary	5
Rent of stable	50
	$244

For two horses the figure comes to the large total of $488, while the teamster to drive these beasts gets $12 a week, which, with a reasonable allowance for wagon and harness costs, brings a total up to the surprising figure of $1125. Therefore we have a per day cost on the basis of 300 working days per year of $3.75. But suppose the firm is unable to use the team more than five-sixths of the time, or two-thirds. We see at once the unit of cost rises. Suppose they could use it only half the time. How much could they pay a team on the outside to come do the work rather than keep their own teams? Manifestly it is just double the cost of the above day rate, or $7.50. Now again suppose they had to keep teams for use one-half or two-thirds of the time. What would it really cost them to do some work for some outside party? That is a question which actually faces almost every farmer in the United States many times each year, although he may not realize it. He has wagons, harness, teams, and often men who are hired by the month. They are there, maintained by the crop needs of the farm. In winter, wet weather, and other times there is nothing for them to do. What does it cost him to put a team on the road at work for the day? Plainly it only costs the additional food of the animals and depreciation of the equipment. It is not fair to add any capital charge. Sometimes farmers do not realize this, and sometimes they do. Acting upon this by-product basis, they have hauled wood and cut railroad ties so diligently that for decades the price of railroad ties in many localities never arose above actual cost of getting them out, sometimes less than that. The tie itself was contributed, merely making an opportunity for the earning of wages, the

farmer doing with his wood or his team practically the same thing Mr. Wanamaker was doing with his shirts—dumping them for what they would bring.

The converse side of this, namely, the high cost per unit of service, of equipment that is rarely used, serves in part to explain the fact that most city men's farms are unprofitable. They are dominated by the idea of making it complete or thorough in its equipment or excellence, and thus they put in some $100 device that isn't used three days a year, and when it is, the cost exceeds any possible return. The wisdom of three Pennsylvania farmers who lived near each other, each of whom contributed certain machines to the three farms, is an interesting example of economically utilizing this cost factor.

It is in international trade we have heard the most about this particular phase of handling the overhead charge. Here is the way it works: A firm is equipped to produce 100,000 units of a given product. The costs of doing this are of two kinds: those which bear a direct relation to the output, and those which bear almost no relation. Thus the capital of the company, the machinery they have, the officers' salaries, and many office expenses are practically constant, and we will assume that they come to $30,000 a year, or 30 cents on a dollar of cost per unit, whereas material is $30,000, and direct labor $40,000. At a selling price of $112,000, the profit is $12,000 a year. What is to be the attitude of the company toward sales at a lower price in a distant market when the home market will take only $80,000 per year? The equipment is there, but an analysis of the full year's accounts shows that it costs

$1 to make a piece of product. Yet the comparison of the second and third table shows clearly that the firm can take the choice between standing idle or running and selling part of its products at less than total cost, and yet making profit by selling goods at less than total cost.

COSTS OF OPERATING A PLANT FOR A YEAR

A. With $100,000 output		*B.* $80,000 output	*C.* $100,000 output, but sold at different prices
Capital and equipment charges................	$20,000	$20,000	$20,000
Office, water, heat, light, etc.	10,000	10,000	10,000
Material.................	30,000	24,000	30,000
Labor direct.............	40,000	32,000	40,000
Cost per unit, $1.........	$100,000	$86,000	$100,000
Sold in home market at $1.12.........100,000 =	112,000	80,000 =89,600	80,000 =89,600
Sold abroad at 80.........	....	....	20,000 =16,000
Total income.........	$112,000	$89,600	$105,600
Profits.............	$12,000	$3,600	$5,600

Since the plant is there, the reasoning that applies to making one extra unit when the plant would otherwise be idle is this: What does one particular unit cost? Plainly, since the plant stands ready, it is the material and direct labor applied to it, namely, 70 cents. Therefore every cent it brings above the 70 goes to reduce the overhead charge and is in that sense a profit, although in another point of view it might be said to merely reduce the loss. It is almost identical again with the fraction of cost that the department store retrieves by selling odds and ends at a very cheap price. Duplicate examples of this reasoning may be found

in indefinite numbers in the examination of productive enterprises, but much more frequently in mercantile ventures.

It has been very disturbing to international trade of late years, because large American concerns facing just this problem, and with the additional factor of desiring to keep a labor force together, have sold steel and many other products abroad at a price which was actual loss and which caused loss to the foreigner who tried to compete. The English call it "dumping," and, owing to the fact that their domestic market price is not kept up by tariff, the British Islands have suffered keenly from the dumping practices of America, Germany, and Belgium. In the early years of this century Joseph Chamberlain, a British iron manufacturer, waged a tariff campaign in England with the idea of having a tariff put up to stop such practices. His campaign failed in England, but Canada has an adjustable tariff to meet this situation. For example, American iron will meet a certain tariff in Canada if sold at the American price. If "dumped," the tariff goes up to stop it. Plainly this is most necessary in Canada, where an iron industry of less than a million tons a year could be utterly swamped with a small fraction of the output of the United States, about 30,000,000 tons a year.

This point of distinction between the primary costs, or those which have a direct relation to the output, and the secondary or overhead costs which have almost no relation to output, is one of profound importance in practically all kinds of production. It has, too, another an entirely different significance. Thus far I have spoken only of the additional use of equipment which must be on hand anyhow

for some other purpose. In the case of the manufacturing plant above mentioned, the equipment was on hand for the period of normal production when the plant ran full. With the farm the equipment must be on hand to make the crop, which is inevitably and (from the cost standpoint) most unfortunately of a seasonal nature. What shall this equipment do the rest of the year? The store gets a product to dump only when there has been some miscarriage of plans. The farmer, and to a lesser extent the factory, has the idle time of equipment dumped on his hands as a part of the ordinary running of the enterprise.

CHAPTER VIII

Dumping of Product as a Profit Factor

In many kinds of manufacture the practice of dumping goes on every day in the year as a part, and a necessary part, of the business. Many by-products are merely another aspect of dumping. What does it cost to produce a gallon of cream? We all know it is to be had by skimming new milk. Suppose five gallons of new milk produce a gallon of cream. It is impossible under these conditions to get cream without first having produced five gallons of new milk, and at the same time producing four gallons of skim milk.

Now turn it around. What does it cost to produce four gallons of skim milk? Plainly the cost of making five gallons of new milk, plus, as in the previous case, the cost of skimming. Now what does it *really* cost to produce this skim milk? Is it not, as a matter of fact, four-fifths of the new milk, and does it not cost four-fifths as much as the total, or four times as much as the cream? From the even division of costs in proportion to the quantity of production, it unquestionably does. Adding to it a bit of agricultural analysis, we find there is actually more drain upon the farm's fertility in the case of milk than in the case of the cream, because it so happens that the fat of cream is produced almost entirely by the elements furnished by the water and air, while skim milk has phosphorus, iron, potash, and other mineral elements which the soil alone can furnish. Therefore it really costs the farmer more of the fertility of his land to produce the skim milk than it does the cream.

Perhaps this cream reasoning makes clear this fact. All discussions of cost, all discussions of management, in fact, almost all discussions of anything human, start with certain assumptions. Geometry which we speak of as an exact science, begins with a pageful of axioms, things which we assume, declare to be true, and lay down on the table as raw material from which we begin the structure. So, in dealing with prices to be obtained, the farmer who said that the skim milk cost the same as the cream, and based his sales upon it, would be a hopeless fool and a prompt bankrupt, for the reason that skim milk will not bring as much as it costs, and therefore the cream must be made to bring more than it costs, or the business can't be done.

Now, again, what does cream cost from a really business standpoint? If five gallons of new milk cost $1 and four gallons of skim milk can be sold for 8 cents, the cream has cost 92 cents. That is the common and practically the only successful method of handling this by-product cost question. Thus creameries selling skim milk at 1 or 2 cents a gallon are really dumping part of the product, and must do so. Turn it around. What does it cost to produce skim milk if the cream sells for 95 cents and the five gallons of new milk cost $1? Plainly four gallons of skim milk cost 5 cents. That is practically the way that oil refineries handle the problem of costs in the exceedingly complex situations that arise in an oil refinery.

Here a thick black liquid runs in through a pipe line from the West and is sold from the refinery as three hundred and even six hundred products, counting the various grades and tests of various kinds of oils, waxes, greases, etc., that the plant puts out. Are they making undue profit on gasoline? Many persons seem to think so. How would

n the production of the
and perhaps a dumped
any small mechanical de-
ny them much more cheaply
nd many inexperienced pro-
ose money on their product
vantage of this fact and try to
l. Many industrial skeletons lie

ew line of product to a factory,
e as soon as the primary cost is
y great importance. What does it
paper publisher to go into the job
hat does it cost the Baltimore tomato
e oyster canning business, which be-
stop? An excellent example of this
griculture, and is shown by the present
orchardists of planting many fillers or
Suppose an acre of land costs $100, which
be covered by 28 apple trees, 40 feet apart.
20 cents, ploughing costs $3 per acre, and
5 cents per tree. Thus ground, trees, plough-
nting will show that the total cost with 28 per
per tree. But for a number of years the ground
d more than the 28 trees. What does it cost per
in these fillers? Plainly, the cost of the tree, 20
the planting, 5 cents, or 25 cents per tree. In
it must be remembered that the ploughing and culti-
over all the ground anyhow, so that the maintenance
extra filler tree that costs 25 cents amounts to only
w costs (primary costs) as certainly pertain to the
self—if we choose to place all the burden on the

you prove it? Manifestly they must consider all their products and all their costs. Their method of handling these hundreds of products is quite simple, practically that which was mentioned above in the case of milk and cream. Take one dollar's worth of oil. By a process of distillation and refining one particular product is extracted, leaving a large amount of residue. If the labor costs 25 cents and the oil $1, and the residue sells for 90 cents, the product that has been taken off has cost the 25 cents of labor and the 10 cents difference in value of material before and after. By the same process 90 cents' worth of raw material is again subjected to a manufacturing process, one product is made and the above cost accounting again applied, and so on through the hundreds of steps necessary to make the different products. But still that does not leave us in a position to say whether or not the gasoline sells too high or too low. It is very much like the situation of two butchers I know. One has his store at a place where there is a heavy demand from a group of wealthy suburbanites who want good roasts, good steaks, and fine cuts, but make small demand on hamburg steak, stewing meat, and soup bones. Consequently this butcher has a heavy supply of these products to get rid of as best he can. Six blocks away, in the midst of fields full of little two-story houses occupied by textile workers, is a little store where somewhat similar quarters of meat are cut up, but the heavy demand is for cheaper cuts. He has high-priced cuts, too, but they are the drug on his market. The discreet housewife living half way between buys her high-priced cuts from the textile workers' butcher, who practically dumps them, and buys her soup bones from the suburbanites' butcher, who practically dumps them. Every quarter of beef that is cut up in the ordinary grocery store

involves this problem. It all comes in at a flat price of 8, 10 or 12 cents; and must be sold to average more than that. If steak can be sold high, soup bones can be sold low, and conversely.

What does it cost for the railroads to carry a passenger? This problem offers so many complexities arising from primary and secondary costs that railroads have for years sheltered behind this complexity, saying that they could not tell what it did cost. It is evident that one more passenger getting on a scheduled train costs the railroad practically nothing, unless you choose to charge the wear and tear he makes on the seats, and you might by a microscopic process say that he costs a couple pounds of coal. His carrying might be regarded as a dumped product, so that it would be profitable to take him 100 miles for a nickel, provided all overhead or secondary costs will be charged to something else. Just what service shall be made to bear these charges? It can be treated a dozen different ways so that you can actually get a dozen different costs for the carrying of this passenger. Quite likely three men equally expert and equally honest might arrive at two or three different kinds of rates, each of which would have equal reasons for appearing fair.

Here is the railroad, with capital costs which represent its construction. Watchmen stand at the crossings, agents preside in the stations, repair gangs tamp the track, general offices are operated. All these things are practically constant, whether the track has six trains a day or sixteen. Now what shall be the attitude toward putting on another train or taking it off? Manifestly something has got to bear the overhead, and the railroads themselves are expert jugglers with this fact. They are tremendous dumpers of their

[illegible] Thus at competitive points like Chicago, where [illegible] a great opportunity to go by other roads or by [illegible] they realize that they must make low rates or they [illegible] get the freight, so that through traffic to competitive points is often sold at rates similar to that of the manufacturing plant mentioned in the last chapter, where [illegible] of its product is sold abroad at something above primary [illegible]. Unquestionably it adds to railroad receipts after the line is built. Non-competitive points are charged a higher rate that provides primary and secondary costs, [illegible] as at the present time many firms in America sell part of their product abroad more cheaply than at home.

What does it cost to print a first-class newspaper with a circulation of five? There must be heavy expenses for [illegible] cabling, for Associated Press dispatches, dozens of reporters covering the country, editors, and vast machinery to turn out these five papers. The first five might cost several hundred dollars. The next five might cost about a dime, [illegible], a little paper, a little ink, a whirl of the press for a second more. Plainly, therefore, there are great economies in large circulation. Similarly the economics of keeping the press rooms busy are causing journals to be published in groups. Every good publishing house, nearly, sells books, publishes a monthly or two, and some weeklies, so that among them all it can keep its plant busy and utilize the technical skill of its experts. For the same reason a publisher of one small journal, if in a publishing centre, is usually making a great error if he does his own printing. He sends it off to a firm that resolves several such contracts into a steady process and keeps its plant busy. If you are manufacturing something, your only product, making it thereby primary and secondary costs, you are often unable

to compete with your rival to whom the production of the same thing is a part of a series and perhaps a dumped product. Thus the makers of many small mechanical devices, metal wares, are able to buy them much more cheaply than they could make them, and many inexperienced producers of patented articles lose money on their product because they fail to take advantage of this fact and try to produce the thing they sell. Many industrial skeletons lie bleaching beside this mire.

Thus, by adding a new line of product to a factory, profit may begin to arise as soon as the primary cost is made—a factor of very great importance. What does it cost the country newspaper publisher to go into the job printing business? What does it cost the Baltimore tomato canner to go into the oyster canning business, which begins when tomatoes stop? An excellent example of this point comes from agriculture, and is shown by the present practice of many orchardists of planting many fillers or temporary trees. Suppose an acre of land costs $100, which will eventually be covered by 28 apple trees, 40 feet apart. The trees cost 20 cents, ploughing costs $3 per acre, and planting costs 5 cents per tree. Thus ground, trees, ploughing, and planting will show that the total cost with 28 per acre is $3.93 per tree. But for a number of years the ground will support more than the 28 trees. What does it cost per tree to put in these fillers? Plainly, the cost of the tree, 20 cents, and the planting, 5 cents, or 25 cents per tree. In its care it must be remembered that the ploughing and cultivation cover all the ground anyhow, so that the maintenance of this extra filler tree that costs 25 cents amounts to only such low costs (primary costs) as certainly pertain to the tree itself—if we choose to place all the burden on the

permanent trees. Here is a fine place to note that costs depend on assumptions.

Another aspect of this same point is seen when we look at the question of the amount that can be paid for some piece of equipment to permit the utilization of something previously thrown away. Here is a firm of cotton manufacturers buying cotton at 10 cents per pound and actually burning cotton waste, 20,000 pounds of it a month. What could they afford to pay for a machine that would enable them to raise that stuff to the value of a cent or two cents a pound?

Problem.—Persons who want to examine this very vital point may derive profit from examining this single example from real life.

A manufacturing company has ground and equipment, \$100,000; interest 6 per cent.; depreciation, 10 per cent.; output, 10,000 machines; material per machine, \$2.40; labor per machine, \$4; selling price, \$10 per machine.

a. What is the rate of profit and the amount of profit?

By the expenditure of \$10,000 for the introduction of high-speed steel and an annual increase of \$6000 in office and superintendence costs, the output can be increased 40 per cent. and the labor cost per machine reduced 50 cents; but 2000 of the machines must be dumped at \$7.50 and 500 must be dumped at \$6.30.

b. What is the rate of profit and the amount of profit?

CHAPTER IX

STANDARDIZATION OF PATTERN AND SPECIALIZATION

WE HEAR a great deal about standardization in present economic discussions, and rightly. What is a standard? I will answer in the words of M. L. Cooke, Director of Public Works, Philadelphia.

"A standard under modern scientific management is simply a carefully-thought-out method of performing a function, or carefully-drawn specifications covering an implement or some article of stores or of product. The idea of perfection is not involved in standardization. The standard method of doing anything is simply the best method that can be devised at the time the standard is drawn. Standard specifications for materials simply cover all the points of possible variation which it is possible to cover at the time the specifications are drawn. Improvements in standards are wanted and adopted whenever and wherever they are found. There is absolutely nothing in standardization to preclude innovation. But to protect standards from changes which are not in the direction of improvement, certain safeguards are erected. These safeguards protect standards from change for the sake of change. All that is demanded under modern scientific management is that a proposed change in a standard must be scrutinized as carefully as the standard was scrutinized prior to its adoption: and, further, that this work be done by experts as competent to do it as were those who originally framed the standard. Standards adopted and protected in this way produce the best that is known at any one time. Standardization practised in this way is a con-

stant invitation to experimentation and improvement." ("Academic and Industrial Efficiency," p. 6.)

This chapter will deal only with one small corner of the great subject of standardization; namely, the form of the product. Standardization in form alone has worked industrial revolutions.

Sixty years ago practically all the shoes worn in the United States were made to order by the custom shoemaker, who had a pair of special lasts for each customer, representing as nearly as possible the exact shape of his feet. Then, as orders for shoes came in, each pair was made up over these special lasts and was a law unto itself. Compare that with the present practice in a large shoe factory in which, instead of having a last or model for John B. Jones's feet, we have a last or model No. 6 A or B or C, and over it, instead of one pair of shoes, will be made a lot of a dozen pairs or a gross or more, perhaps also in several styles. This may be repeated several times in each year. Suppose the custom shoemaker's pair of lasts cost \$3. Allowing interest and a moderate depreciation—for the lasts die with their owner—we have some 20 to 25 cents as the annual cost of these lasts, without counting care and bother they are to the man who must keep them, so that on two pairs of shoes per year there is a last cost of 12 or 15 cents a pair, a sum of money which would probably serve as fair profit for a pair of shoes in a modern factory. It is easy to see that there must be much more work in preparing the uppers and in making a pair of shoes which is a law unto itself rather than making a dozen just alike. That is why a pair of custom-made shoes made over the customer's special last in a modern factory cost \$2 or \$3 per pair more than the same quality of shoe turned out

by the same factory, but varying in some respect by one-fourth or one-eighth of an inch.

This specialization in manufacture is one of the new and widely significant things in the present machine production epoch, and in some of its developments has caused much comment. International trade at the beginning of this century was greatly disturbed. One of the most widely known cases arising from it was the building of the Atbara Bridge. In 1898 Lord Kitchener, in command of an English army on the Upper Nile, pursued the Sudanese Mahdi several hundred miles beyond the head of navigation or any Egyptian railroad, and it became imperative to establish better connections with this army as quickly as possible. Advertisements were inserted in papers in various countries for a bridge of given specifications to cross one of the branches of the Nile. European tenders to the British Government called for from four to eighteen months to ship the structure. The Pencoyd Iron Works, in a suburb of Philadelphia, offered to do it in six weeks. This time was so surprising that the company had some difficulty in convincing the authorities that it was in earnest and could deliver the goods, which, however, it succeeded in doing on contract time with no difficulty. The point was that the process of bridge building had became standardized here, but not in Europe. The American bridge companies were making up, and often kept on hand, moderate supplies of standard shapes of structural steel, I-beams, angle irons, channel irons, and plates of varying sizes and thicknesses, so that on demand bridge builders could cut them into lengths and rivet them together and make almost anything within reasonable limits, as the carpenter could go to the lumber yard and build many simple constructions, including, for example, a wooden

bridge, by merely cutting assorted timbers and fastening them together. If the American Bridge Company did not at that time happen to have the rolled material on hand, it at least had the rolls already made with the proper grooves in them to roll this kind of material on a very few days' notice. Europe, with its practice of special-made products, often found each new bridge a law unto itself, requiring special design and the manufacture of special parts. Hence the greater length of time required, and the great international interest and excitement over the Atbara Bridge incident, and even alarm at the amazing prospect of the American conquest of the iron market.

The difference between the special product and standard product is perhaps even more plainly shown in the case of an engine than in the case of a bridge. We often hear that a firm has secured a special engine. What is implied? In the first place, some very skilful person must have enough of a concept of the cost and therefore the details of the proposed special engine to make a reasonable bid, which must be low enough to get the order and high enough to provide profit. After the contract is secured, an expert in engine design must take its specifications, work them out in the rough, hand various parts over to his assistants for minute and accurate calculations down to the one-hundredth of an inch. These calculations, in turn, must be handed over to the draftsman, who transfers the abstract idea into the physical form of drawings, which are, in turn, converted into blue-prints. Those prints are then handed over to a pattern maker, who is a very skilful wood-worker with enough imagination to see in these tangled lines the perfect forms with length, breadth, and thickness, and with skill enough to take wood and with nails, screws,

belts, glue, and various shaping instruments, make an exact model of a crank-shaft or a fly-wheel, or any of the other parts of the special engine. This is not a cheap process, but it is one of universal application in many lines. No locomotive wheel ever existed in steel without first existing in the perfect wooden form resulting from the pattern maker's art. After the pattern is made, it goes over to the foundry, where the moulder's skill imbeds it between two boxes of packed moulding sand and loam so that the two boxes can be lifted apart and the pattern lifted out, leaving between the two halves of the replaced moulding sand a cavity bearing the perfect shape of the pattern. This, by the way, is the first stage in the manufacture of the engine proper. All this preliminary work is absolutely dead and non-productive. It has made nothing, and after it has been done for one engine it costs as much as if it had been done for one hundred or perhaps five hundred made upon the same outlines.

After the wheel is cast, it must go to the machine shop, have the rough taken off by lathes, boring and drilling machines, and perhaps other machine tools. It takes considerable time to adjust some of these tools for each different piece of work, so that the cost of fixing up one wheel is partly work and partly getting ready for it. The cost of the second one would be merely work. The assembling and erection of this special engine is again a law unto itself, requiring most careful comparisons of specifications with performances.

Cost Aspects.—What are the cost aspects of this special engine in contrast to the standardized engine? Suppose, instead of making a special engine, the firm turns out a 3- or 10-horse-power standard engine of which they

wish to sell a dozen or a hundred, as the shoe factory expects to sell dozens and hundreds of shoes. To start with, the firm, if going to put on a new line of goods, would choose its own time for designing. In periods of dull times and slack work the designing department could take the most leisurely and careful pains in making a perfect design to get the greatest efficiency for minimum cost. Contrast this with the hurry in designing the special engine to get it out by a certain time. Once completed the designs, drawings, blue-prints, and patterns of the standardized engine are capable of indefinite use. The moulder gets skill in making many parts alike. The machinist who does the lathe work need not reset his machine, and if the firm limits itself to a few varieties it can use much simpler machines. Thus one of the great elements of the leadership of the Baldwin Locomotive Works in Philadelphia in the field of locomotive manufacture lies in the fact that they have so simplified the work to be done by each machine that it can be done by a simple machine and operated by men of small training and small skill, and therefore of low wage. These men get the speed of repetition as well as speed that arises from not having to reset machines. This point is admirably illustrated by the following costs for machining a given piece in a machine shop:

1	piece costs	25 cents.
2	pieces cost	15 cents each.
5	pieces cost	10 cents each.
100	pieces cost	5 cents each.
500	pieces cost	3 cents each.

The high cost of the first was due chiefly to the setting of the machine and to the awkwardness of doing a piece of work for the first time. The cheapness of the last piece shows practically no element of cost for setting the machine.

The man had learned the necessary trick to do this piece of work as a skilled typewriter becomes acquainted with a machine. If one wishes really to appreciate the point involved here, let him see how long it takes to tie a four-in-hand tie on his own neck and on another person's neck. This process shows the force of habit in giving us manual dexterity through mechanically repeating operations such as those that make up manufacturing.

One of the reasons why British ships are so much cheaper than American ships is the fact that they take advantage of standardization and specialization in manufacture. We rarely build more than two ships alike. The British often build a half dozen or a dozen. Thus the design for one marine engine is utilized in manufacture a dozen times. Maybe it is laid aside and duplicated the next year. The machinist sets the rolls to bond plates, not for one ship only, but for a dozen. The inspection of the last ten of the dozen becomes a simple matter in comparison with the inspection of the first.

Relation to Other Cost Factors.—It might be perhaps fair to think of the designing and pattern-making part of the special engine as a kind of overhead charge. Similarly the setting of the machines for a particular kind of work should be considered a kind of overhead charge, which becomes a little or big part according to the amount of output that must bear it. This great point of the advantage of standardization is almost identical in its cost aspect with the previous topics showing the advantages of large-scale production and continuous operation. They might all have been classed under overhead charge, or spoken of under the title "The full utilization of material." Thus a square yard of wall is more productive of a shelter in a part of a

big room than in a little room. We found that the farmer's wagon was a more effective investment of capital in terms of unit cost than the reaper because it is used more times. Almost identical is the frequent use of a pattern or the setting of a machine tool.

Movement Toward Specialization.—These advantages of standardization are driving factory managers to narrow the list of things they produce. The old shoemaker by the roadside made a whole shoe, and from baby size to grandfather size; whereas, there are now whole factories which make nothing but shoe heels, uppers, or insoles for other factories to put together with a few more parts of their own make. No shoe factory makes a complete assortment of shoes. A modern factory that covers acres may be busy making men's or women's shoes of a certain general class, and often of a limited number of sizes. The Ford automobile is the sole product of a vast works. Why shouldn't the automobile factory make a dozen kinds of autos for the dozen kinds of trade? It probably would have done so fifty years ago, as did the engine companies which made dozens of kinds of special designs. But the Ford establishment has attained its position of tremendous preëminence because it has standardized and specialized to the limit. It sells a touring car and runabout, and so far as possible the process of standardization goes through both of them, making them absolutely alike so far as all the operating parts are concerned. They have the same engine, same steering gear, same axle, same wheels, same clutch. They may differ a little as to the length of running gear, which is a matter of simplicity, and in some details of the bed, which is again simple. I happen to know of an automobile manufacturing firm founded by a salesman who was

so foolish as to be influenced by the constant demands of his customers for an automobile that was different from those he had to sell. He heard this for years until finally he persuaded a group of capitalists to help him finance a company to make the kind of automobile each person wanted. He turned out anything people called for—at least for a short time until the loss of $400,000 capital wound up the enterprise. He had not the shadow of a chance in competition with standardized works. The customers who *talked* about special cars were not, in most cases, willing to pay for them.

Cotton spinners make a few sizes of yarn. Textile mills make one or two kinds of cotton cloth in a few grades only. Thus there are print mills, duck mills, gingham mills, and many others. The Oneida Community offers an interesting evolution in variety of output an enterprise should make. This community was formed some sixty years ago on the communistic basis, and so continued for nearly half a century. Everybody worked and did the work he knew how to do. A spinner established the sewing silk trade. There were jewellers. There was a blacksmith who made steel traps and dog chains. They made canned goods from the surplus crops on their farms. At the end of fifty years the communistic idea was abandoned and the people reorganized a stock company. In a few years they had sold the silk business to a Connecticut company. The steel-trap business and the dog-chain business were closely allied, but they sold the dog-chain business. Presently the fruit canning practically died out, and they are now pushing just two lines, silver-plate ware of the community brand, and steel traps. Other examples of this tendency toward special-

ization of output are to be found on every hand, for low costs demand it.

The Influence upon Markets and upon Trade.— Naturally the result of specialization is that the output assumes a uniformity which in machine manufacture results in interchangeable parts, an occurrence of vast significance in industry. Forty years ago a certain skilled machinist in the agricultural district in Maryland had one-fourth of an acre of ground around his shop, which at times was well covered with wagons, drills, and other farm machines that were brought in to be repaired. If the machines were broken, they took them to Isaac Russell because he was the most skilled mechanic within miles and could replace any piece on almost any machine. There has been little industrial change in that community. The farmers are still growing wheat, corn and hay. The repair plant still runs and is still in the hands of a skilled mechanic, but the yard is no longer full. When the farmer breaks his machine, he looks at the broken part, reads the catalogue number, telephones the agent who sold it to him. The agent says he has it or can get it from Baltimore to-morrow by telegraph if in a hurry, or he will quite likely go out back of his warehouse and take a usable piece from a discarded machine he has taken in trade. Instead of having a skilful piece of repair work, you have the buying of a casting. It is difficult to appreciate the full significance of this change. Machines can now be used not only in the immediate vicinity of skilled mechanics who can repair them, but anywhere that agencies can be established. Thus American reapers cut the grain crops of Argentine, Russia, and Germany as easily as those of Dakota or Canada. Think what would happen if the Ford automobile could be used only in

the vicinity of places where broken parts could be repaired. It would mean that the machines would be drawn by horses scores or even hundreds of miles at times to repair shops, and the possibility of extended utilization would be but a small fraction of the present practice.

Influence of Interchangeable Parts on Quality.—Standardization, specialization, and interchangeability of parts have been a great boon by widening the scope of markets. Yet they have beyond a doubt had an injurious effect upon the quality of output. They tend to make the kinds of product that can be made by the mile and cut off in lengths. They are excellent for coarse stuff, bad for good stuff. We see this in the cheap dollar watch, a great boon to the day laborer and to those who desire cheap timepieces. It is retailed for $1 and wholesaled for about 60 cents. It is a supreme triumph of interchangeable parts and standardized manufacture, but when we want the best kind of timepiece we must still go to the type of watch which receives some individual care.

It is perhaps a good joke on one of the leading Philadelphia jewelry firms that the head of the house has his own magnificent watch repaired not in his own works, but around the corner in a little shop run by a European who learned watchmaking in the old-fashioned way.

The greatest injury, however, that standardization works on the foreign trade and industry of the country is in the rigidity and lack of possible adjustment. It is all right for Mr. Cooke to say that there is nothing in standardization to preclude innovation, but he is talking philosophy, not costs. Manufacturers talk costs most of the time. They have to. The whole object of standardization is to get just one way of making the product. This permits

less and cheaper machinery and many advantages as mentioned above, but suppose an improvement is invented. It throws this whole rigid machinery out of order and often subjects the firm to considerable cost. So long as things are being made on special orders, a change in design comes in the day's work, but this highly organized, standardized plant is thrown out by such an improvement. Consequently we get here one of the reasons for smothering of patents, which is a very considerable evil of the present. A firm realizes that if a certain improvement is not made by its rivals it will not have to make it itself. Therefore it buys the patent, puts it in the safe, and lets the public suffer its loss. Meanwhile, Europe, thoroughly alarmed in 1900 by the invasion of foreign trade by our standardization, has been steadily making improvements and is not at the present time so seriously alarmed. However, it is undoubtedly true that processes of mechanical improvement are still increasing the quality of the standardized product, especially where competition is keen. Proofs of this are shown by the mechanical excellence of the automobile, typewriter, and bicycle. Beyond a doubt standardization has come to stay and to assume a steadily increasing rôle. How far will standardization make us specialize?

Limits of Specialization.—Special manufacture is limited by the ability to reduce commodities to type. The law of averages helps with the process, which is manifestly easier where large rather than small numbers are dealt with. Thus the shoemaker with one hundred customers may only have two or three whose feet are so much alike that they can wear a shoe made up on the same last. So he has ninety-seven varieties for one hundred customers. If he had 40,000, he might not need more than two hundred sizes

and shapes to fit 95 per cent. of the people. Thus the law of averages would widen the market and constantly permit shoe manufacturers to put on new lasts that take some trade away from the custom shoemaker. It enables the clothes manufacturer each year to make new sizes of clothes that will fit some small group of long-armed or thin-chested or thick-chested people who before that time had been compelled to go to the tailor.

Steadiness of the demand is a factor of no mean importance in deciding the extent to which specialization can go. A staple commodity of permanent demand is safe where a specialty of uncertain demand is a risk, because the factory that is adjusted to make certain specialties may be ruined by the disappearance of the demand, as was the case years ago with certain English steel mills that had, through a period of years, become adjusted to the sole production of the fine steel springs for the manufacture of women's hoopskirts, for years in universal demand. They suddenly went out of style, leaving the factories closed as though a war had come.

Effect upon the Worker.—One large part of the advantage of standardization is that it requires less skill. It tends to substitute method for skill. Instead of having the high-grade mechanic capable of completing a job, we have the low-grade machine tender to do a simple mechanical process. Instead of having him change from job to job, he repeats the same job many times and indefinitely. Many persons claim, and perhaps with cause, that this monotony tends to be destructive of personality and injurious to the worker. This is an important point and one on which we need more knowledge than we at present have. It will be discussed later in this book.

Standard Unit Enterprises.—A form of standardization is seen where persons devise such a unit as a grocery store or a ten-cent store, and, having worked out in one place the best method of doing this thing, simply repeat it elsewhere. Thus came the vast chains of grocery stores and the hundreds of ten-cent stores operated by a single enterprise. Beyond a doubt, these stores are more efficient than would be a similar number of stores in which each grocer was a law unto himself. Some do it well, some do it ill. The chain store represents a multiplication of the best, as by planting seed we multiply a good strain of plants.

CHAPTER X

How Big Should an Enterprise Be?

The advantage of large-scale equipment and operation of standardization and specialization all seem to indicate that the gigantic enterprise is the most efficient enterprise. There is, beyond a doubt, some best size for each and every enterprise. What is it?

This is a question incapable of any definite answer, as was that question put to Abraham Lincoln as to how long a man's legs ought to be. The questioner made reference to the illustrious Stephen A. Douglas, saying that he had very short legs, while his political rival had very long ones. But the story-teller of Illinois replied that he was uncertain as to the proper length, but thought they ought to be about long enough to reach from his body to the ground. So an enterprise should be large enough to reach its maximum of efficiency. This is a point laid down by many combined circumstances, chief of which is referred to by the economists' term, "The point of diminishing returns" or "The law of diminishing returns," which may be stated somewhat as follows. In the beginning of an enterprise increases of capital and labor produce proportional, or more than proportional, increases in output. If, however, the process is continued, a point is reached beyond which further increases of capital and labor do not produce proportional increase in output. This law is of universal application in human activity, whether the merchant, manufacturer, or farmer who comes against it ever heard of it or not. One of the nicest examples of its limiting influence

is afforded by a ship. The resistance of the water through which it passes increases rapidly with the increase of the speed, so much so that it costs twice as much to drive a ship across the ocean at twenty-five knots an hour as it does at twenty. The increased cost is partly caused by increased coal consumption, which in turn demands larger capacity to hold the coal and more men to handle it, making greater costs and greater depreciation and at the same time reducing storage space. Therefore no commercial ship has ever been built to exceed twenty-six knots. Many slower ones have been built since the Mauretania and Lusitania were built at this speed, the reason being that the increased costs of the greater speed are not met by increased earning power. Go to the other extreme. Plainly it is very inexpensive in coal and machine costs to drive a ship across the sea at five knots an hour, but this, too, is unprofitable, for the reason that the long time consumed means an unduly high wage roll, since men are hired by the month, and unduly low income from the freight, because the pay for freight is so much per ton or per passenger for carrying across the ocean. Thus the speed of five knots, like that of twenty-five knots, is unprofitable. High speed and low speed alike drive the ship into the realm of diminishing returns. As a matter of fact, the freighter's best speed is now nine to eleven knots per hour under average freights and cost of operation. The question of speed of a ship is thereby a straight and narrow pathway, with dangers lurking on both sides to attack the profit sheet.

Increasing Returns—a Force Toward Bigness.—If one will turn back and read the chapter on "Dumping of Product as a Profit Factor," he can see that many of the examples therein mentioned are really cases of work where

the management takes advantage of the law of increasing returns. Thus the street-car tracks of a city which are idle in the middle of the night might do a large freight business, in which the effort is plainly an example of increasing returns. So is the building of traffic of a railroad up to the point where it is working to its full capacity. An examination of the reports of a road like the Pennsylvania, with its many branches, some busy, some half idle, shows some surprising train mileage costs and track mileage incomes, varying with the degree of utilization and showing great opportunities for increased efforts at increased returns if the railroad had anything that it could do with that particular equipment.

Stated in general terms, an enterprise has reached its maximum size when all its machines and all its men are busy at their maximum capacity. This is a general statement of a condition which I suppose has rarely existed in any plant in its entirety. The more nearly it is approached, the greater the efficiency. In the varying conditions of different industries and different managers, the size for this maximum of efficiency varies tremendously, with many factors tending toward large size.

Many overhead charges about a factory tend to be the same whether the factory is little or big. Many a purchaser could purchase for a factory five times as big as the one he serves. Sometimes a salesman could sell for a factory larger than he has. Therefore this is a force tending to make the factory large.

The large factory can apply division of labor better than the small one. The custom tailor with two or three helpers has a coat made by from one to three persons. In the sweat-shop it is divided up between a large number.

In the modern clothing factory the number of persons working upon the coat is twenty to thirty. What is the proper number of subdivisions of processes in making a coat or any other product? Plainly this advantage of division of labor has its limits and its maximum number of divisions—a point set by the law of diminishing returns. If twenty is the best number of workers, fifteen work at a disadvantage, so do twenty-five.

The big factory can take advantage of new things in improvements much more easily than a small factory. Many large enterprises have a department that does nothing but investigate. A great drug firm is reported to pay one chemist $20,000 a year because he has great ability to make improvements and discoveries which give them new commodities to sell and better the old ones on their list. The large firm can specialize, which is really only taking advantage of division of labor, a point that has been adequately covered.

The large firm can often do things in the marketing and advertising and establishment of good-will which the small firm cannot do. Thus the words, "Uneeda Biscuit," known to millions of people, are reported to represent an expenditure of one million dollars. Unless the company has been big enough to sell over the whole nation, it could not afford to advertise over the whole nation. If it had tried to advertise in part of it, it probably would have found it more expensive per person to do so.

The common advantages of buying in large lots, and having carload shipments in and out, are too well known to require discussion.

A large enterprise, by its prestige and its large prizes in salaries. can attract better brains than the small enter-

prise. The small enterprise which is your own can give, however, an independence that rarely comes of being a cog in a great wheel.

Advantages of Small Enterprises.—On the other hand, there are certain advantages which inhere in the small enterprise. We hear on every hand that $5000 and $10,000 men are to be had, but the $50,000 men are scarcer than the positions demanding them. Therefore the enterprise that is big enough to demand $50,000 men may find itself hard put, whereas firms that require $5000 men can find them. Enterprises must not outgrow in size the available human capacity. Beyond a doubt men of moderate capacity are more numerous than men of gigantic capacity. Every man some time reaches his limit, and when he oversteps it the fact is often only demonstrated by serious financial loss. Many a man can succeed admirably when he comes in personal contact with all who work with him. His qualities of generosity, of kindness, of good-fellowship, count. His associates and underlings love him and give him service that money cannot measure. He goes up a peg. He deals with foremen. They deal with the individuals who do the work. The hold between the worker and the chief is broken. Friction arises, failure follows, because the man has passed his limit.

There are many places where there is a small supply of raw material which limits the size of enterprises, or a small market which limits.

The size of some enterprise is set absolutely by technical considerations. Thus it has been stated that it requires $25,000,000 or $30,000,000 to go into the steel business on a proper scale. The blast furnace itself costs $1,000,000. There should be a bank of them. There should also be

steel furnaces and rolling mills. To do it well there should also be coke ovens, lime quarries, iron ore plants, miles of railroad, steamships, costing altogether a total of many millions of dollars, so that a mere millionaire has not a look-in if he should wish to start the steel business. Oil refineries have heavy capital requirements, so do sugar refineries, making it impossible for these enterprises to be carried on in a small way.

The Influence of Inspection on the Size of an Enterprise.—There are some enterprises that look very good on paper and in their elements they are good. I will place at the head of this list of great producing agencies the hen. The American hen has greater output per year by far than the American blast furnace or the American gold mine, in fact, more than those two combined. Millions of people know that a hen, with care, will produce $1 to $2 per year profit. Thus 1000 would yield $1500 profit, 4000 would yield $6000, and where are the men who are getting $6000 salaries? As a result of this pencil calculation, hundreds of enthusiasts every year start into the poultry business, but somehow they find that 100 hens do not yield quite so much per hen as did 10, and 1000 not so much as 100. Before the 2000 mark is reached, a hennery is for sale. Why? Because of the vast amount of inspection required to keep these animals adequately cared for and to keep them healthy. Beyond a doubt there is a savor of truth in the statement that a person who can run a hen farm well can also run a railroad.

The proposition of the poultry farm is typical of agriculture in general. The acre unit figures up all right as a business proposition, but we do not often find farm enterprises with 50 or 100 men working under one supervisor,

because of the difficulty of inspection that arises from the lack of concentration of the work of 100 workers spread over a vast area. It is impossible for the employer to supervise them all the time, and assistants to give adequate supervision make inspection cost so much that agriculture usually breaks up into small units. In those cases where many employees are required, it is always intensive agriculture with great production on small areas. Compare for a moment the inspection problem involved where forty men are working on a 10,000-acre farm, or sixteen square miles of land, and where forty men are working on the one floor of a machine shop. It would take one or two men in automobiles all day to get around to see the forty men on 10,000 acres, and then there would be scarcely five minutes to devote to each employee. The inspector in the machine shop need never see the forty men. He could merely look over at his leisure their output perhaps at the end of a day, and could catch their imperfections and hold them responsible for it. This is utterly impossible in the case of the farm.

CHAPTER XI

The Location of Industry

Where Should a Factory or an Industry Be?—What locates an industry? At once the persons of whom that is asked answer, "Raw material," or "labor," or "market," or "power," or "transportation facilities," or occasionally even "capital." Their ideas are derived from cases in which the one or the other of these things is more important. For my own purpose, I wish to limit the discussion largely to raw material, market, labor, and power. Capital is scarcely worthy of discussion as a locating factor, because of its great mobility. Where the other factors combine to make a prospect of profit, there, granted political stability, capital will go, whether it is to build a huge mill and a town in the woods of Maine for the manufacture of paper, to dig oil wells in the mosquito-ridden swamps on the Gulf of Mexico, or to upper Yukon. Similarly, transportation facilities, which so often come to persons' minds as a factor locating many manufacturing plants, I prefer to discuss in connection with their influence on the one or the other of the factors of material or market. Transportation is even less than capital a locating factor except in a secondary way. Transport, like capital, comes where the goods demand it.

Raw Materials.—Every commodity that is manufactured is at one time a raw material, that passes from the place of production of the raw material to the place of ultimate consumption, which in many cases is thousands of miles away. Somewhere on that journey between the place of production and the place of final consumption,

labor and capital and machinery are applied to this raw material to fabricate it into the various products. Shall it be done near the place of origin of raw materials, or near the place of consumption, the market? This question is answered by considering the relative costs of transportation of raw materials and of finished products, or the relative cost of labor or of power.

Raw Material as a Locating Factor.—Take the case of lumber. Its raw material is a sawlog, an exceedingly difficult unit to handle. Furthermore, a 10,000-pound sawlog when finally squared up, slabs thrown away, sawed into planks and the sawdust thrown away, may easily weigh not more than 5000 or 6000 pounds, and this net weight is in many pieces, very easy to handle. Thus the actual reduction in weight and great increase in ease of handling the pieces combine to drive the production of lumber as far back toward the stump on which the log grew as possible. For this reason the actual size of the lumber manufacturing plant depends upon the ease of assembling logs. In Maine and other lumber regions having a heavy snow mantle, the saw-mill tends to be large because the snow makes easy sledding for the logs from the forests to the stream banks, and the spring freshet makes easy rafting down stream. For this reason Bangor can assemble logs for a large area and manufacture lumber on a large scale. In the rough country of Appalachia, where there is less snow, these conditions do not prevail. It is quite common for the portable saw-mill to saw only the logs from a few acres in one place and then move along a quarter or half mile and saw up a few acres more.

The canning of fruits and vegetables requires raw material difficult and almost impossible of transportation to

any great distance, because of its perishable nature. While there are undoubtedly economies in large-scale canning, the difficulty of assembling the raw material in great quantities more than offsets the advantages, with the result that canning factories are scattered in great number in the small towns of the farming regions that happen to produce tomatoes, corn, beans, and the fruits that are canned. In the main these goods are rarely shipped by rail to the canning factory. The factory goes to the place where they can be assembled in the wagons of the producing farmers.

The meat-packing plants offer in their varying locations interesting responses to technical changes. Before the coming of the refrigerator car it was impossible most of the year to take fresh meat from Chicago to New York and Boston. For that reason train loads of live cattle were shipped from Chicago stock yards to the abattoirs of these eastern cities. Then in the '70s came the refrigerator car, and it became possible to bring fresh meat from Chicago and the West. A carload of live animals is the most expensive form for the shipping of meat. It is easy to see there will be far less of them in a car than when they hang in quarters and halves, packed closely together, reaching upward to the roof. Furthermore, the live animals must be kept alive, a process that costs and adds nothing, and the discomforts of the journey cause them to lose weight, often twenty-five to fifty pounds per head, so there are manifestly savings in doing the slaughtering as near as possible to the centres of raw material, namely, fat cattle.

How far into the farming districts can the meat packing go? One firm put up a plant in Nebraska at a railroad junction in an almost uninhabited prairie. It failed. Although it had the advantages of transportation above men-

tioned, it lacked the city market for many of the less desirable parts of the animals that are used as food by the poorer classes of people, chiefly foreigners. They had overreached in their effort to get good freights. The balancing of factors dictates that the meat-packing plant shall be located in the cities nearest to the places of production of the animal. Chicago still continues to be the greatest centre, and every city of importance beyond it is becoming a meat-packing centre,—Des Moines, Sioux City, Cedar Rapids, Kansas City, and, of late, Fort Worth, Texas.

An Assembling Industry.—There are some manufacturers' plants which have as their raw material the finished products of other plants. A manufacturer of fine electrical specialties in New York has his plant in some dark and noisy, cave-like rooms opposite the elevated railroads in one of the streets of lower New York. "Why do you not move out?" I asked him. "Because," he answered, "I may want a special brass casting any morning or any afternoon. There is a little brass foundry around the corner that will make it for me. I may want some kind of special copper work, some tubing, some wire, some peculiar metal work or hardware of a hundred shapes and kinds. I can get them all here in New York. If I should go out on Long Island or out in the country, I would be handicapped." This statement explains the removal of the manufacturer of electrical specialties from the comfortable city of Lancaster, Pa., with its admirable food supplies and labor supplies, to the more crowded New York, where he could come in contact with the numerous other industries that supplied the things he needed.

This is typical of the very large group of assembling industries of which nearly all machines are examples to some

extent. These finished parts are raw material and have an influence on factory location that may be likened to that of a forest on saw-mill location.

The iron industry offers an excellent illustration of the locating force of raw materials. From 3500 to 4500 pounds of ore, nearly a ton of fuel, and several hundred pounds of limestone, totalling between three and four tons, are put through a great furnace to produce one ton of iron, which when finished must sell for less than one cent a pound. Manifestly the relatively high cost of transportation of these heavy raw materials dictates that the plant producing this finished product must be located at a moderately convenient point for the assembling of raw materials. As between the two main raw materials of ore and fuel, the ore commonly goes to the fuel, chiefly because it is easier to transport. Coal and coke grind up and are injured by the breaking that comes from jarring and handling in transit. Ore is absolutely uninjured by anything we can do to it. It can be beaten and pounded, laid out in the rain ten years, dropped into the bottom of a lake or a river, frozen or burned, and it is still good ore. Therefore it tends to travel to the more perishable fuel.

The Influence of Market.—Agricultural implements are made of wood and iron. Therefore we would expect to find them, if located by raw materials, to be either in a lumber or an iron centre. But a carload of lumber and a carload of pig iron and a carload of steel will make many carloads of reapers and cultivators, and we at once see how the transportation factor tends to make the condensed raw materials go as far toward the market as is possible, so that the farming region using the agricultural machinery is the factor, the market factor, that tends to locate the manu-

facture of agricultural machinery. It has for forty years clung to a good distributing centre on the edge of the farming belt. The first great centre was Auburn, New York, back in the '70s. In 1880, Springfield, Ohio, led. In 1900, Chicago, the great metropolis of the corn belt, the oat belt, the hay belt, lying upon the edge of the greatest block of level land suitable for farm machinery and commercially adjacent to any city, became predominant in the manufacture of farming implements, making several times as much as any other city. It still holds its leadership, although the making of these goods is springing up in other cities in the corn belt just as is the meat-packing industry.

A Planing Mill.—Lumber manufacturing was cited above as an example of an industry located entirely by raw material. On the other hand, it has for years been common for planing-mill products to be made near the market. Carloads of rough planks can be subjected to much rough handling and an occasional wetting, but such is not the case with window sashes, shutters, doors, mouldings for window frames, and the balustrades, stairways, and other pieces of mill-work used in the construction of houses. Thus, while the saw-mill is in the forest, the planing mill is usually in the city where the goods are utilized.

The machine tool industry offers another good example of the locating influence of market. Machine tools are used in machine shops, and machine shops tend to be located near other manufactures, for they constitute the market for machinery. The market for machine tools is chiefly in the manufacturing district of the United States, which reaches from southern Maine to Chicago and the Mississippi River, and from the Great Lakes down to eastern Pennsylvania, Delaware, and Baltimore, Louisville, Cincinnati, St. Louis,

with scattered centres in the South. With a market so big, where is the place for the manufacture of machine tools? Naturally there arise several centres. New England is supplied from Worcester, Springfield, and Providence; the southeastern district from Paterson and Philadelphia; the western district has important centres at Cincinnati, Hamilton, Dayton, Cleveland, and Pittsburgh, all of which cities have a short haul and quick connections with all the manufacturing centres in the western end of the manufacturing region.

The influence of immediate centres of consumption upon such industries as bread-baking and sugar refining is too patent to require discussion. Similarly the manufacture of boxes and barrels and many other products of extreme bulk must be centred close to the market, and these products are shipped but little by rail in their finished form, although the distant lumber mill makes staves for the barrels and shooks for the box factories, which are themselves located in cities or towns immediately adjacent to the ultimate user.

The Iron Industry.—Within the zone producing the raw material for iron we find some interesting evidence of market influence upon the location of industry. The great iron centre is in western Pennsylvania, in the Pittsburgh district, but there is a tendency for the industry to start up elsewhere. It is beginning to revive in southeastern Pennsylvania and at Buffalo. An iron industry still persists on Lake Champlain, and one is rising at the head of Lake Superior. Why? Because of the influence of market. Thus if iron is to be made of Lake Superior ore and Pittsburgh coal, and used in New York, the ore goes to Pittsburgh or even to Buffalo for manufacture, where it is combined with

Pittsburgh coke and goes on to its eastern market. But if it is for consumption in Alberta or Dakota, the Pittsburgh coke goes to the head of Lake Superior to combine with Lake Superior ore and onward to the western market. Thus we see in every case the straight travel of raw material from the place of origin to the place of consumption, but still manufactured within the region producing the two main raw materials.

The Labor Influence.—The examples which have been used to illustrate the influence of raw materials and market have been those in which the costs of transportation were so heavy that they constituted the dominating location force. In other types of industry the cost of transportation is so light that the raw materials and the finished products can go great distances with little relative cost, leaving labor and power to act as the important locating factors. The textiles offer excellent examples of this. Allowing 4 cents a pound per board foot and $20 a thousand for price at the mill, we find that a freight rate of $10 a ton is 100 per cent. of the cost of the lumber. Compare the relative cost of some freight rates on raw material. Take the case of iron ore worth $4 a ton. A freight rate of $2 per ton there amounts to 50 per cent., a cost factor of the gravest import. In the case of lumber weighing four pounds per board foot, 1000 feet weighing two tons, and a freight rate of $5 a ton becomes $10, or 50 per cent. on a mill valuation of $20 a thousand. Cotton at 10 cents per pound, or $200 a ton, can pay a $10 freight rate and sacrifice but 5 per cent. of its valuation. Thus we see the ease with which cotton can go from Texas to New England by rail and back to California for consumption. The fact that certain regions produce a textile fibre is therefore little reason why they should

become the place for the textile manufacture. In fact, it amounts almost to a disadvantage, for the reason that it is easier to move bales of raw cotton than bales of cotton cloth, especially when the freight rate is lower on bales of cotton than on cloth or cotton yarn. Here we have almost the condition that prevailed with regard to the boards and the planing mill. The fact that New Mexico and Montana and Australia produce fine wool is no reason whatever why those regions should produce the cloth, because wool is more valuable even than cotton and the freight rate tends to be of even less relative importance. But we get the supreme example of all in the case of silk, in which the raw material has a value of $2 per pound and upward. Its value per ton becomes $4000, and a freight rate of $40 a ton is but 1 per cent. and almost a negligible factor. We see silk produced on one side of the world, namely, China and Japan, and carried clear to the other side of the world for manufacture at a place where labor conditions happen to be favorable.

The silk mill is what the economists call a parasitic industry, because it is really attached to another industry and does not stand upon its own feet, as does, for example, iron manufacture. The silk mill requires a very high percentage of female labor. Therefore it tends to go to regions where there are heavy industries requiring large numbers of men. In such localities the women and girls of the family tend to be relatively unemployed, and consequently there is a good labor supply. Thus the machine shops of Paterson employ the men, the silk mills the women. In recent years there has been a great increase in the silk business in Pennsylvania, because in the anthracite region 175,000 miners are employed about the mines, and there is a large female population available for labor. Similarly in the cement

district of the Lehigh Valley and in the machinery manufacturing centre at York silk mills have recently been established.

Fine Metal Products.—Products in which the labor element is relatively large can be made in those places where people are most numerous and the labor supply is best. An enumeration of the places of manufacture of the things in a hardware store will show the surprising pre-eminence of New England. Two towns in Vermont make practically all the scales in the United States; namely, the Fairbanks and the Howe. Guns and rifles come largely from Massachusetts. Within thirty miles of Providence is the great centre of the manufacture of jewelry. Connecticut produces much of the silverware, and turns out large quantities of clocks, both cheap and good. The list of New England manufactures might be carried on to a great length, but in nearly all cases it will be shown that they comprise imported raw material, such as iron, steel, fabrics, leather, in which the total percentage of raw material value is low and the percentage of labor cost is high.

The Influence of Power.—Power, as separate from fuel, is a factor which tends to be like labor, a dominating factor only in industries with raw materials capable of easy transport, if they happen not to be produced in the immediate vicinity of the power. Much of New England's manufacture had its start through the influence of waterfalls. At the present time large parts of the manufacturing districts of New England are dependent, not upon water-power, but upon coal imported from Pennsylvania and West Virginia. There its relative unimportance as fuel is, however, rather surprising. The coal bill of a Rhode Island cotton yarn mill which produced a million dollars' worth of yarn was only

$40,000, giving a fuel bill of 4 per cent. Another place having cheaper coal supplies might produce as much yarn with a mill fuel cost as low as 2 or 3 per cent., the difference being but a small advantage, which might easily be offset by superiority of skilled labor or technical education.

Electric smelting is perhaps the best example of an industry dominated almost exclusively by power. Small quantities of aluminum or carbon or other substances are put through an electric furnaee, which is nothing but a box through which a great electric current runs, making heat as the current jumps from the opposite poles of the electric arc. It produces greater heat than any other kind of furnace man has been able to devise, and is used for the most difficult kind of smelting, including the making of the artificial diamonds used as abrasives, or carborundum. It uses power in vast quantities, and is consequently located near the great power plants at Niagara Falls at Massena, New York, on the Falls of the St. Lawrence, along the eastern slopes of the Alps, and in Norway and Sweden.

The making of wood pulp is another power-located industry. It starts with a log four or five feet in length, and often a foot in diameter. The log is chopped to pieces and in some cases ground to powder, a process that requires large amounts of power, many horse-power hours per ton of wood. This explains the fact that nearly two-thirds of the water-power in the United States is employed in pulp factories. Most of these factories happen to have locations favorable for the two elements of raw material and water-power, the streams flowing out of the forests of New England and New York and the Upper Lakes providing water-power at the very edge of the wood-producing district.

The Influence of an Early Start.—Any one who is

acquainted with the location of a dozen manufacturing plants has probably already thought that the factors given in the above analysis do not seem to cover the majority of cases he has in mind. That is probably true of the majority of factories in the United States. How does it happen so? Because of the accident of an early start. Why did you happen to get into your present position? Because you were born in a certain place and happened by chance to meet certain people. That's all. Baldwin Locomotive Works got located in Philadelphia because a man named Baldwin went down to the wharf when the first locomotive was imported from England, and, seeing this engine, his creative genius was stirred and he decided that he could and would make one. With a few helpers he went to his shop and made it. Then he wanted to make another and needed a new building, so went to the outskirts of Philadelphia, bought a cheap piece of land too wet and swampy to build houses on. Thus the great Baldwin Locomotive Works got started. It grew and the town grew around it, and now they have a most abominable location in the heart of the city. It is no longer wet and swampy, but it is not capable of extension except by purchase and destruction of city buildings. The plant must move. That is like the location of the major part of our factories. They are situated where somebody made a start experimentally with limited capital. The plant got too big to run away from, the owner was not able to move it, and it stayed often in cramped and awkward quarters, the location violating many visible principles that should govern plant location.

The Relocation of a Plant.—When a company gets able to move its plant to a new location, we see the results of careful analysis. Two examples will suffice. The Lacka-

wanna Steel Company years ago had blast furnaces and rolling mills on a hill at Scranton, Pa. It started there because of the ore and coal near by. When the time came to use Lake Superior ore, naturally the haul from Buffalo to Scranton was necessary. This continued until finally the company abandoned its former quarters, with all the loss that the removal of a plant involves, and relocated at Buffalo, where Lake Superior ores could be loaded from the steamer direct to the ore bin of the blast furnace. Since the fuel came from Pittsburgh in both cases, at practically the same cost, the plant gained by the elimination of the ore haul from Buffalo to Scranton.

A similar course of reasoning caused the Steel Corporation to build the greatest steel plant in the world, not at Pittsburgh, which was really the home of the Steel Corporation, but at Gary, a few miles out of Chicago, where lots of room could be had immediately adjacent to Lake Michigan, so that boats and furnaces could meet.

CHAPTER XII

The Location of a Factory

In a broad sense a factory is, or should be, located according to the demand of the dominant factor as outlined in the preceding chapter. In the narrowest sense it should be located where it can get adequate local transport connections and, of course, ample physical space to place itself satisfactorily to get light and to grow.

When it comes to the consideration of exact locations they may be of three types: city, country, and suburban. Each has its advantages.

The city location has one of its advantages in labor. There are thousands of families there, and by the law of averages we get greater possibilities of an abundant and varied supply of labor. Conversely, the cities, by having many factories convenient to the families that wish work, give the possibility of many jobs. A one-factory town may not offer work for a family, whereas a city may have opportunities for the bread-winner, the young man, and the girl. From the standpoint of the factory, however, the city worker has to get higher wages because of the higher cost of living—a great disadvantage.

In the matter of supplies, the city is usually far ahead of the country because the needs of many users and buyers make possible the machine shops, the repair shops, hardware stores, and stocks of raw material on which the manufacturer can draw with greater ease and speed than he could in a country location.

Similarly, fire protection is apt to be better in the city than in either the suburbs or the country.

The advantages, however, tend to be offset by the higher costs for the plant. Land is high if it must be bought, or rents are high if it must be rented. These factors tend to make physical construction cramped and crowded. In many plants in the city it is necessary to go up and down stairs, of working in dark places, in damp and unwholesome places, merely because they are in the city. Furthermore, the fact that the city has many people makes it necessary to have many restrictions which the absence of neighbors would not require. Danger of fire often makes more costly construction necessary. Sundry smells and noises are a nuisance which certain localities cannot permit, and, as cities grow, factories often find themselves more and more in conflict with the community and finally are at times actually driven out because they become nuisances in large communities, although they might not have done so in small communities. The removal of Baldwin Locomotive Works from Philadelphia is an excellent illustration of all these points, but especially of the crushing power of space limitations.

The Country Location.—The country location offers, first, and above all, splendid facilities for plant location. The price of a city lot will sometimes pay for a whole field in the country, giving all the room that a factory could possibly want if it grew to five-fold its initial size. Whereas location in the city often necessitates carting and trucking, the country can without difficulty afford space for connections with a railroad.

The isolation of the country factory often permits economies of structure which necessary fire restrictions of a city would not permit.

Wages in the country are also less than in the city because of the lower cost of living. But despite these advantages the manufacturer dreads to move to the country. One of the

big reasons is that if he needs skilled laborers they do not like to go, since the country usually offers less social opportunity than the town. Above all, it offers less business opportunity. The workman who moves from the city knows that when he goes to a one-factory town he faces complete idleness if the one factory closes, whereas in the city he has at least the possibility of going to some other works. While this offers small relief in cases of general depression, the worker who moves to the one-factory town thereby places himself largely at the mercy of the one firm. Their fate is his fate, for a cemetery is scarcely more dead than a one-factory town when that factory is shut up. Furthermore, the manufacturer who places his plant in the country usually finds no houses and finds it necessary to build them and incur capital cost, which he does not have to incur in the city, where other investors have houses already built.

The Suburban Location.—The suburb, which combines to a considerable extent the advantages of both country and city, is therefore the generally used location for the great factory of the present. Land is cheap enough for a good factory site, workers have the advantage of being near the town, and trolley lines can bring more workers. This movement to the suburb, however, is one which is undoubtedly costing the nation untold millions of dollars and causing great waste of resources. The suburb of to-day becomes the city of to-morrow and we tear down and tear down and tear down—a frightful waste for which there is no return. The problem of the scientific planning and the construction of the factory city is one which has never been seriously and scientifically attacked in the United States. It is a problem, however, on which some interesting light may be shed by experiments which have been made in certain foreign countries.

CHAPTER XIII

The Model Factory Town

Man has been building cities for 6000 years, but for some strange reason an ant-hill is much more efficiently planned than is London, New York, or Chicago—granting, of course, that a city is built for people to live in and also do business in.

When an architect builds a factory, he lays down upon the table before him a list of the various things the factory is to do, and then proceeds from these known needs to create a structure which will best meet them. It seems almost beyond belief that, despite our thousands of years of experience with cities, there has been so little attempt to apply large-scale planning to the idea of the city as a functioning unit. Is it any more desirable that a city should grow indefinitely large than that a man should grow indefinitely large? Perhaps most of us as little boys have wished the wish of fairies that we might be as big as a giant so that we might pick up certain undesirable persons between our fingers and place them where they belonged. Is the world-wide desire of cities to grow big, big, big, any more sane? My answer is emphatically "No." A city is to perform certain functions, and when it is big enough to perform those, additional size is of no more value than an additional one hundred pounds is to a man who already weighs one hundred and eighty.

The World's Greatest Town Planner.—Mr. Ebenezer Howard, an Englishman, sat down and drew up the plans of an ideal city. He first analyzed the proposition. The

city affords to its inhabitants the social opportunity of numbers, to the factory the labor market of numbers, but it tends inevitably to crowd. On the other hand, the advantages of the country are room to grow things in the yard and garden, room to play, fresh air, and nearness to food supplies. But along with these advantages is lack of social opportunity. Then, having put these things down on the table, he proceeded to plan a city which was to be constructed on the cardinal principles of having all the inhabitants so placed that they were so near their factories that they could walk to their jobs, so near to open space that they could easily walk to the farms, fields, and playgrounds, yet sufficiently numerous to make the labor supply for factories which produce. This, after all, is the object of the city. These ends can be attained only by having a definite size for the city. This means limitation of the population. Why have more if the city is big enough? His plan of the ideal city was that it should be circular, with an open park in the centre, around which were gathered the public buildings, of which the city needed but one, such as the town library, town hall, theatre, opera house, museums, etc. Then came some four or five circular streets of residence; one of these was to be widened out and have a park space in the middle of it with room for schoolhouses, churches, masonic buildings, and other semipublic structures. The last street from the centre was to be a row of factories with a belt line railroad behind them, and, beyond that, open ground for garden plots and farm land.

Nothing New About it.—By the application of our well-established principles of building restrictions crowding was kept out by limiting the size of lots to a certain minimum and by limiting the proportions of a lot that could be covered by a house. Thus Mr. Howard figured that the city would

be full grown with about 32,000, more or less, depending upon the size of the families. After this city was full, increased residence needs could be met by building another city near by, just as we build the next suburban station on the railroad. In the ideal plan about 6000 acres are required for the city, of which about half are left for farms, and the remainder for streets and residence use.

How it Works.—The average American predicts failure for any such enterprise. However, England feels the city problem much more keenly than we do in this country, for it has had the industrial city longer, and in recruiting for armies, particularly for the Boer War, England has discovered with horror the physical degeneration which results from generations of city life, with inadequate dwelling facilities, no gardens, no ground, no playing facilities. After much hard work, Mr. Howard succeeded in forming a Garden City Association that raised enough subscriptions of cash to start, although they did not get the necessary one and one-half million dollars which they thought they should have. They bought about 4000 acres of farm land forty miles north of London, in Hertfordshire, on one of the great railroads, and proceeded to set apart the central half of it for city, lay out streets, and plan a factory town. Owing to the contour of the ground, there was no attempt to maintain the circular idea of the abstract plan, but all the principles were applied; namely, nearness of the man to his job, to the open country, to play space, to stores, and a roomy lot for each residence. It has succeeded. In nine years, between 1904 and 1912, about thirty factories have moved to the place, which had a population of 8000 and was steadily increasing. The crucial test, however, of its success is the balance sheet. It was financed by a group

of individuals who were willing to put up some money, buy the land, and get their 5 per cent. cumulative dividends eventually if it succeeded. It followed the usual English plan of giving long leases to land and letting tenants improve. This is the way in which many other English cities have been built, for England is a country of large estates, where land sales are rare and leases common. The company bought land at farm value and rented at low town values. Thus the cottager who buys a lease for a plot pays perhaps $10 a year for the lot, but as there are seven or eight such lots per acre, the income on the original purchase price of $200 is ample. Thus these leases which had been sold when the town was one-quarter grown caused the balance sheet for the year 1912 to show a profit. The financial plan provides that the promoters shall get 5 per cent., and after that further profits shall go to the city in improvements and reduction of taxes. One of the manufacturers told me he could foresee the time when the town would be without taxes, and then the manufacturers would come there "in droves."

Its Appeal to the Manufacturer.—I regard this attempt to eliminate the crowding evil from the manufacturing town as perhaps the most important single social experiment going on in Europe, for it is a statistical fact that no large city population anywhere is physically and numerically maintaining itself. Before the outbreak of the war of 1914 I spent several days in this city, going through it very carefully to see how it appealed to the manufacturers. I had letters of introduction to the prophets of the place, but really I did not care how it appealed to the prophets, for I knew that in advance. I did not care how it appealed to the poets, the artists, the retired bankers, the maiden ladies living on snug incomes, nor the cranks, nor the merchants who sold

to all these, nor even to the workers who made up the bulk of the population. The worker goes where there are jobs. The butcher, the baker, and the candlestick maker come to serve him, so that the vital part of a city is the way it appeals to the man who promotes the basal industry, which is usually manufacturing. Therefore I interviewed the manufacturers of the place, making a special attempt to try to find those who had most distinctly what you would call the "practical" turn of mind in contrast to the altruistic. Everywhere I found the same enthusiasm. I went to get their ideas, but first I must go and look at their plants. They all pointed out the great superiority of the plants on these two- or three-acre cheap sites over the plants they had left in London, many of which were crowded, and so dark as to be lighted by gas, and so inadequate as to interfere with the best efficiency of work.

Perhaps the best interview was given by an automobile manufacturer who had been the hardest to persuade to come there, and who finally consented to do so for the following reasons, as he stated them:

"*First.*—When a man bangs about in an omnibus for an hour and even more, morning and evening, going to and from work, as my men did, I figured it was wearing him out, and making him less efficient for his work. I also figured that the six-pence he had to pay for that finally came out of me.

"*Second.*—In London, where there were lots of works, we found the men were becoming rovers, increasingly so. If a man did not like it in my works, he could move to the next. When he needed a little discipline, he would get mad and quit, and go to the next place, where he would do the same thing and be none the better for the move. It cost

us at least two pounds sterling when a man quit. Now where there are less works of a kind up here a man will listen to reason, is a little more dependent on his job, learns, and becomes a better worker.

"*Third.*—The building restrictions appeal to me. In London, if I wanted to put a stove-pipe through a foundry shed roof, I had to draw up plans and specifications, apply to the board of building inspectors, pay a fee, and maybe wait thirty days for them to get around to it, and perhaps be refused. Here, if I want to do it, I go ahead and stick her out. My plant is so far from the next plant that it can catch fire and burn down if it wants to without much danger to others. In London a rubber plant came and stood alongside of mine, and the underwriters put my insurance up 100 per cent. Here that can not happen. I have signed a uniform contract with the company, like every other manufacturer has, and I know just what they can do and what I can't do.

"I found out one thing that I never believed. I had heard, of course, lots of socialists and other people say that if a man had a nice new factory, with plenty of light and air and good recreation, he worked better, but, Lord, Mr. Smith, I never believed it. But it's a fact. I know, for I have brought men here from London, have brought the machines with them, and the same men worked on the same machines at the same rate of pay with the same inspection and same bonus system, the same number of hours per week, making exactly the same brand of machine, and they turned out more work. It amounts to between 7 per cent. and 8 per cent. That cuts down overhead charge, and what's more, the quality of the output is better. I can't give you that in percentage, but I have been running these works for fifteen

years and I know. The stuff goes through better, and less material is spoiled.

"When the work is over, the children come up to the factory gates to meet their fathers, and they are home in ten minutes. You ought to see this place on Saturday afternoons. It is full of football games. Every works has a football team or two, or sometimes three. All the teams play match games with each other in winter and cricket games in the summer."

It is not an uncommon thing to see a factory in the corner of a three-acre lot over which it may eventually grow. Meanwhile football goal posts indicate the use the ground is being put to. Owing to the fact that this land is bought at a low lease per year, the works can easily afford to rent three acres of ground for expansion.

It is the most beautiful factory town I have ever seen, for the reason that every house has room enough for flowers in front and vegetables behind. At no place do they have lots more than twelve to the acre, which means that lots can be practically 20 x 215 feet, even in sections given over to the artisan. That means provision for a small front yard, cottage site, little back yard, and 100 feet left for garden in the rear. A labor agitator with whom I had a long interview on Sunday told me he could pretty nearly tell how long a man had been there by looking at his garden. The first year after arriving from London he did not do much. Then summer came, the neighbors began to hand vegetables across the line. The next year he made a start, and by the third year his garden began to be of some real value.

Inasmuch as the town is definitely planned, it has ample factory districts on railroad sidings, and there is on each side of this a large district given over to cottages for factory

workers. This is reserved for factory workers, by building restrictions which insist that houses shall cost up to a certain minimum, but not beyond a certain maximum. That practically means artisans' cottages. Beyond that in both directions are larger lots, at higher rent, with different building restrictions, which means middle class. On the highest ground still farther away from the factories, are yet larger and more expensive lots where factory owners and persons of some means have their beautiful homes. Near the station is the natural place for the shopping district, while immediately across from it is a 70-acre playground, with several smaller ones of twelve, five, three, and one-half acres, etc., scattered about the place, which is, so far as I know, the only town of its size in the world that has convenient public provision for simultaneous play of any large percentage of its population.

The limitation of the city size is provided for in building restrictions. By this means these facilities of accessibility and play space become permanent. Just beyond the factory district come the farm holdings. Perhaps Mr. Howard's dream of a town that combines the advantages of both city and country will come true. It has certainly made a good start.

The Needless Reconstruction of Indefinitely Planned Cities.—The fact that this Garden City is definitely planned saves it from the endless turmoil of reconstruction which a growing city encounters, owing to the fact that, as the city grows, each part has a different use with every generation. Therefore each generation tears down what the previous generation built to last for many decades. Thus in Philadelphia and in New York the business section is invading the residence section, either using awkward old residences,

or tearing down and building anew. In 1914 a block of splendid, substantial houses worth many thousands of dollars was torn away near the University of Pennsylvania to make room for another University building. That great University, with 5000 students on the campus, has outdoor space for one football or baseball team at a time, leaving the other 99 3/5 per cent. of the students without the possibilities of outdoor athletics at that time. Thus the city has swamped itself and its institutions, as all growing cities do where every building operation and every unit of growth is part of the heterogeneous effort of individuals each striving independently and unrelatedly for his own gain. The supreme example of this waste is perhaps shown by the subway, that fearfully expensive kind of construction that never should have been. The suburbs of a growing city are successively swamped by new uses. Because the people are expecting in a short time to sell for building purposes, the land is held for high prices and the chief occupation of the land that should be in crops is the support of "For sale" signs. Around Garden City is a belt of farms and playgrounds, which, owing to the fact that it is definitely set apart for these uses, has and can have no sale value, in which respect it resembles our parks.

The significant part of the whole thing is that it has been done by the application of existing practices and existing laws with existing human science. Most attempts at social reconstruction have to await a conversion of the majority to a new point of view, and if the dreams of the socialist come true, we must also develop an entirely new system and type of business administration. In contrast to that millennial process, a garden city like Letchworth, England, can be built in any well-chosen location and any group

of capitalists with constructive imagination can start in and do it under existing law. It merely requires common things plus vision. Truly it has been said that where there is no vision the people perish. Let the old cities alone, but build new ones to take care of the growth of industry and population.

As to its areal aspects—there is plenty of room along the Delaware River for all the industrial population now near it (and much more) to be so situated that they could avail themselves of all the principles involved in Garden City and have the best access to the harbor. They now have very poor access to the harbor, to the land, and to each other.

If our urban people lived in such cities as Garden City, it would beyond a doubt reduce the cost of living, increase wealth through by-industry, increase pleasure through the possibilities of recreation, increase efficiency through increased health. The land speculator alone would lose—lose his present much-too-widespread opportunity to take something and give nothing in return. Something for nothing is a process that is variously regarded, according to our social enlightenment.

From the standpoint of factory location it will be noted that such a garden city has, from the factory standpoint, country sites, and city labor supply. This labor supply lives under lower cost of living than the city. In the case of Letchworth the rate of wages was often 25 per cent. less than in London, but the worker got a much better living with the lower wage.

CHAPTER XIV

The Model Factory

The model factory is a construction that has had all the careful thought applied to it that we have referred to in the ideal city plan. As this is a comparatively simple problem, and an individual rather than a social problem, it has had vast amounts of thought and labor expended upon it. If the model city had had half as much constructive imagination applied to it we would be in a different age.

The Plan of the Factory.—The ideal of factory construction is to provide for the continuous motion of material through it from the beginning of the work to the end of the work, which is to be carried on with the least possible effort. This fact of continuity of process is of varying importance in industries, depending on the kind of raw material. For example, in a textile mill the material is so light and so valuable per unit of weight that it can be moved with great ease. There is small cost in taking unfinished product from the second floor to the fifth for better light and then perhaps back to the first floor for another process. Because of these facts, textile mills are often in good locations from the standpoint of manufacture when they are in such cramped quarters as to be far from ideal in plan. But the cost sacrifices in awkward planning are so small that they are more than offset by the advantages that come from abundant labor supply to be found in all densely peopled localities.

Contrast this with a steel plant, which must use vast amounts of heavy materials of low value, limestone at \$2 a ton, ore at \$4 a ton, etc. Here the movement of these low-

priced, heavy raw materials is a factor which must be attended to with the greatest possible thought. Carrying it from one story to another is unthinkable. Such a plant is always limited to one story. Some indication of the amount of handling within a plant is shown by the fact that the Gary steel plant has within its yards 175 miles of railroad, a distance about as great as from New York to Baltimore. Here great pains have been taken to so grade the ground that in certain places large stretches of tracks will be on a slight incline so that cars will run by the force of gravity when left in certain positions. Great saving was hit upon when blast furnaces were set at an angle of 23 degrees to the ore docks, so that trains of material that came alongside would have to make a 67-degree curve turn rather than a 90-degree curve in getting from the blast furnace down to the converters, soaking pits, and the rolling mills.

In the steel mill another factor tends to enhance the value of the plan, and that is the temperature of the material handled. It is molten or white hot or red hot. Cooling and reheating is a needless expense. It must start as ore and be kept hot until finally thrown out as a practically finished piece. Hence great consideration is given to getting a location that permits the ideal plant. Such steel plants are never started in the city. They require so much space that it is necessary to buy a farm, often several of them, and steel plants are usually, therefore, established in country localities, which promptly become cities because of the huge demands for labor.

The Gravity Plant.—Sugar refining begins by melting up the brown sugar, and the process of refining is chiefly one of handling liquids. After liquids are pumped to the top floor of the building they can easily run down to the next

story, go through a process, run down the next story and go through the next process, until finally they slide down the chute at the bottom to be packed up or barrelled up and slid down a little farther to wagons or cars. This is particularly easy in the case of the sugar, which starts as a liquid but comes out as a granular solid. Therefore, instead of a flat structure for a sugar refinery, we see a high, narrow one, sometimes nearly 100 feet high. This is particularly serviceable, because a large city is of itself a great market for sugar, and the sugar refinery can afford to have even on the harbor front of a great city the high-priced but small lot which suffices.

The general external structure of a flour mill is quite similar to that of the sugar refinery, as the work consists in repeatedly running the wheat through the mills that crush it somewhat, after which it is sifted and run through more rollers. This makes a vast amount of lifting up by steam and running down by gravity through the various machines. Lifting up by steam and running down by gravity is the desired method of handling material in all kinds of producing and carrying work, and the extent to which it is utilized is continually increasing.

The Plant for Handling Liquids.—This type is best illustrated by the oil refineries. Since the raw material—petroleum—and most of the finished products of an oil refinery can, by means of force pumps, be transferred from place to place through pipes set at an angle, the plant can be made up of a large number of scattered units, arranged in any manner desired. The form of the plant is of little more importance than is the form of a jelly-fish, provided there is sufficient space to place the units far enough away from each other. In an oil refinery the unit is a still, a big

iron tank holding perhaps fifty barrels, under which fire burns and boils the liquid until it vaporizes. The more highly volatile substances go off first, the least volatile go off last and finally leave the residue of hard coke. For convenience sake the man in charge of this work may have a dozen stills going, but watch them all from one room. The pipes through which the distillate (the recondensed vapors) runs away are all brought to one point where the inspector can examine the character of the liquid and, as its quality changes, shut it off from one pipe to another, and send it off to the different receptacles throughout the plant.

Direct Production versus Indirect Production.—Some kinds of plants, such as a textile mill, take the raw material, put it through repeated processes until it is finished. Nothing is added, no important by-products are taken away. Such a process goes on conveniently in one large building, which shows from afar its singular compactness. This is in contrast to an indirect producing plant, such as a machine shop, which has a foundry, a pattern department, and often other departments, some of which may be housed in separate buildings. Perhaps the best example of this type of plant is shown by a meat-packing plant in which the complete carcass is separated in many parts, each of which becomes in turn the raw material for a separate by-product industry, such as the sausage or soap department, fertilizer department, buttons, blood-drying, etc. Here again we see these numerous sub-industries housed in a number of small plants which must, for the purpose of sanitation and safety, be separate.

The Assembling Industries.—Aside from the steel plant, perhaps the layout of the works assumes its next highest importance in plants where the industry is distinctly

of the assembling character, such, for example, as the automobile manufactory. I believe there is no plant in the world that makes a complete automobile. All automobile manufacturers buy engines, bearings, forgings, wheels, castings, or lamps. Sometimes hundreds of parts are brought to the works, combined with the few that are made, and the whole put together as a completed machine. The bringing of these many parts together most efficiently is really one of the difficult arts of factory planning. Suppose a 40-cents-an-hour man wastes a minute and a half. There is a cent gone. In the Ford plant, turning out three hundred thousand automobiles a year, the loss at one cent per machine is $3000. Fifty cents per machine amounts to $150,000. Is it any wonder that the contemplation of these appalling facts has made the Ford erecting floor one of the marvels of the manufacturing world! All the numerous parts of the automobile are brought together along lines of travel that do not interfere with each other. They come to the right man at the right time, with the least possible loss of motion, so that the machine can be put together with great speed and therefore with great economy. It is needless to say that this principle and the placing of material and parts is one of universal application in manufacture of any sort, particularly of the assembling kind.

In the shipyard, plan is almost as important as in the Ford automobile plant, although the product may be but half a dozen or a dozen ships per year. However, the task becomes bothersome and possibly wasteful because of the great weight of the pieces involved in putting together a ship, and particularly the great marine engine. Here the planning is therefore centred around the idea of cheap

handling of heavy material rather than speed in handling numerous small parts.

The Cost of a Plant.—When a concern has some money, there is great temptation to expend in non-productive ornament or needless equipment. This is a temptation to which perhaps financial institutions with one-story buildings on million-dollar sites have been peculiarly prone, but manufacturers are not entirely innocent of it. To what shall these extra thousands of dollars be charged? Are they productive? If they can be fairly considered as part of advertising expenses, they are. Otherwise they have the same relation to production as does a painting by an old master in the library of the plant owner.

There is one subject upon which our concept of cost is rapidly changing. Not long ago the idea of nice, white, sanitary wash-rooms, rest-rooms, extra clean interiors of factories, reading-rooms, trained nurses in charge where there is a large staff of women, flower-beds, and other niceties of this sort were considered to be luxuries, an advertisement, or philanthropy—an objectionable term to the American workman. We have discovered that for a hen to lay eggs and lots of them she must be warm, comfortable, and happy, as well as well-fed. Identically the same thing has been discovered about the cow if she is going to give milk abundantly. It is not philanthropy to treat your cow well and make her happy. American manufacturers are coming to the realization that it is not philanthropy to keep the factory in such physical condition that people feel good and comfortable in it.

I would recall particularly the testimony of the automobile manufacturer quoted in the last chapter, who discovered a 7 per cent. increase in output when he got to the

model factory town of Garden City (Letchworth), England. His statistics prove his findings to be identical with the recommendation made by almost every student of factory construction who has recently written in America, as for example, Dr. Diemer, in his well-known book on "Factory Organization and Administration." The money spent in keeping a plant adequately warm, light, and well ventilated is not a philanthropy, and is as essential a part of construction and operation expenditure as is a good roof that does not leak, and fire insurance. Dr. Diemer says this should go to the point in most large works of having air washed to keep dust out of it, and moistened to make it more wholesome. The removal of dust by putting it through a tank of wet coke or through sprays of water is beneficial not only to the health of the worker, but to the quality of most kinds of material, even many kinds of metal work, and the bearings of the machinery.

Persons desiring to go more fully into the study of the planning of factories should read the chapters in J. C. Duncan's "Principles of Industrial Management," published by D. Appleton Company, New York; also Hugo Diemer's "Factory Organization and Administration," McGraw-Hill Company, and "Industrial Plants," by Day.

CHAPTER XV

THE QUALITY OF LABOR

MANUFACTURING or almost any other kind of production consists in the use of psychology, physiology, and many inanimate forces. The inanimate forces we can control very definitely, but the human end of the labor problem has doubtless bothered men ever since one man worked for another one. What is work?

Work is the result of habit. By this I do not mean the work habit. Some people have the habit of working, and they will work whether they need to or not, because it has become with them a habit. By saying that work is a habit, I mean that the various complex motions or groups of motions that are required to do particular operations of work must become *habitual*—automatic—with the workman. When we begin to learn a task involving several motions we are compelled to think out each motion as it is performed, and the work proceeds very slowly, but little by little the necessity for mental effort in connection with each movement disappears, and finally our muscles and nerve centres are so trained and coördinated that we can perform the work without thought; indeed, we can do it faster than thought. Until this becomes the case, we are not workers; we are merely learners. Thus, in beginning, we spent much effort and care in teaching our feet to walk, until they do it for us. So our tongue learns to talk, and it performs its operations without thought, as the hands of the person running the typewriter find the keys automatically. So long as they are found as the result of thought,

the work is too slow to be work. It is merely a practice exercise. The physiologists delight to tell the joke one soldier plays upon another by calling suddenly in a voice of command, "Attention!" Whereupon down go the hands to the side, whether there happens to be dinner in them or not, because the hands have been taught to obey that word quicker than thought; just as we bat our eyes at a motion or keep our balance with our feet.

As a crowning example of this automatic process, Thomas Edison tells of the telegraph operators in the Nashville office who received over the wire the signals which spelled out the fact that President Lincoln was assassinated. They wrote it on paper, passed it out of the office, but only became aware of the assassination when they heard the boys calling the news in the street; to these men the process of receiving telegrams had become an automatic habit, independent of the thought conveyed by the letters they took down.

This reducing ourselves to automata is what makes us efficient workers, and the great service that division of labor has rendered industry has been to so reduce the scope and size of our job that we could learn it more quickly and reduce it more perfectly to habit, giving greater speed. An efficient business organization consists in bringing together a lot of persons who have a set of habits that correlate properly to make the complete whole, just as arms, legs, heart, stomach, etc., must correlate to aid a man. The satisfactory man is satisfactory in his place because when certain things happen or when certain conditions arise he responds to them in a certain way as a result of habit. But for this habituation, the man could not hold the job.

When we get into the realm where it is impossible to

apply habit and repetition, we get into the difficult and highly-paid work—the creative work. Some repair work is of that sort, and costs much more than new work. Thus the plumber who comes to mend your frozen pipes presents what seems to be a very unreasonable bill. The fact is, he has been doing a job unlike his latest one or his next one. He had to work it out himself, do it in an awkward place, and the bill is many times what it would have been if the work could have been one of a thousand similar tasks all done in the shop.

The Limits of Repetition.—Repeated work becomes tiresome. Fatigue is a poison, or the result of one, and it limits our efficiency. Herein we get the great drawback of specialization and the limiting factor for the utilization of habit—repetition. Considerable effort has been applied in the attempt to find relief from this monotony. Some kinds of work, such as the making of cigars, which is quiet but must be done by hand, are often relieved by having somebody read aloud in a room full of workers. Sometimes music is resorted to for the same purpose. It seems to be a fact that if we can move in rhythm, even work to rhythm, we like it better. Negroes, with their keen sense for music, often sing a tune and work to it, as in street and railway building. There have been several books written upon the question of rhythm and labor.

Where work does not occupy the mind, but still must be done by human hands, and the mind has a chance to wander, and where noise makes reading impossible, home study, university extension courses, evening schools, and correspondence courses give food for thought that may enliven the otherwise dull hours when the hands are busy and the mind

is not. They may, of course, fit the worker for a more pleasant job.

This problem of the effect of monotonous labor upon man is comparatively new, having been introduced by the machine epoch. Very little of the old-fashioned hand labor was as monotonous as some machine tending, because it required attention and the constant exercise of some skill, and therefore the problem of monotony was almost entirely unknown. We will doubtless develop tests which will show us that some kinds of work are more destructive than drink, and can not be tolerated. Perhaps we will get relief by having men do two kinds of work or perhaps three, so that three men will have three machines and operate them for different parts of the day, thus giving themselves relief from the continued strain on one set of muscles and nerves in one kind of operation. It is, of eourse, well known that change of work is relatively rest, especially when it is from brain work to physical. Thus the famous and prolific writer Tolstoi devoted a part of each day to some kind of technical skilful physical labor, such as shoemaking, to offset his brain work.

The Classes of Workers as Divided by Sex and Age. Comparison of Men and Women.—Man is undoubtedly stronger physically, on the average, than woman, and for that reason many kinds of work are his exclusively.

Man is also a more permanent employee than woman. The young man knows, when he enters a position, that the pay of the beginner is relatively small in comparison to that of men at the top who may be doing somewhat similar work. Therefore he expects to work up by staying on or getting promoted to similar work elsewhere. In contrast to this life attitude, the woman goes to work ordinarily with

a temporary viewpoint. Statistics, of course, show that the great majority of women eventually marry and drop out of industry. Therefore, why spend years in preparing themselves if the total working period is short? Consequently her attitude toward the task is less permanent, and she is less inclined to spend the necessary years in preparation for the life aspect of the task. It would not, on the average, pay her to do otherwise.

Growing out of the different attitudes of the two sexes is the question of wages. Theoretically, at least, a man's wage is based upon the idea of supporting a family; theoretically, the average woman worker is supporting herself, which accounts for the fact that wages of men are, in the main, higher than the wages of women, even where work is somewhat the same. Boys and girls are often paid pittances on the theory that they are living at home.

It is generally agreed that man has more initiative than woman. Initiative is the quality which finds ways to remove difficulties instead of enduring them. It is from initiative that inventions arise, and new things are brought to pass A comparison of sexes in this regard is partly shown by the number of patents that woman has taken out in comparison with the number that man has taken out. In the Patent Office at Washington the figure is not very far from 1 to 100 in favor of the men. It should be noted that man has had, through his work, much greater opportunity for invention, but still that ratio cannot be explained on that ground alone. Although woman has worked in the kitchen, most of the kitchen devices have been invented by men. Even the great dressmakers—Worth, Paquin—are men. They should, however, be called dress designers rather than dressmakers, as it is design that makes their clothes so prized. Some have at-

tributed man's greater initiative to the fact that he has had better educational opportunities than woman and that he has greater physical strength. This, I believe, is not the case. I believe the cause is much further to seek and much deeper. Human beings are in a large part the result of their past. If a sex has certain qualities, it is because the race has need to breed those qualities into it. For unknown ages primitive man lived in the small tribe or family group in which it was the man's task to catch game, fight enemies, and cope with the difficulties that required initiative, while woman had the much more monotonous task of staying by the staff and raising a family. Therefore she has developed patience and endurance, and there is no more exacting task in the world to-day than that of being all day, twenty-four hours per day, year in and year out, with a family of small children, as is the average mother. She hears their cries by night and their numerous questions by day. They are ever on her mind. This is an ability to endure which man probably does not possess. It is the complementary ability to that of initiative. In industry it shows itself in a painstaking fidelity to detail, particularly to monotonous detail, in which woman shows distinct superiority to man. Perhaps one of the greatest illustrations of this is shown by the Scranton International Correspondence School, where hundreds of girls sit all day long for months, marking a single examination paper, dotting "i's," crossing "t's," putting in commas, and making it right, the same old paper day after day, from thousands of people all over the world. As an expert who studied this institution put it, "They do it without objection, they do it willingly and cheerfully when a man would go crazy."

Inasmuch as the working-girls of to-day are to be, to a large extent, the mothers of the next generation, we have, acting in the interest of social welfare as well as from a sense of common decency, endeavored to afford them the protection which their lack of physical strength makes necessary, by passing laws regulating the hours of labor, and the sanitary and other conditions under which they may work. It is plain that the growing acceptance of the principle that every man is his brother's keeper is giving an added impetus to this movement, which, after all, is merely an indication that society is becoming better adjusted to present economic conditions. From the employer's point of view this legislation is a disadvantage which to a certain extent offsets the advantages of the low scale of wages for female labor.

Dexterity.—The smallness of her hand and her more delicate organism give woman a dexterity in small work which makes her very much at home in certain machine operations where the work is light. A large proportion of our important machinery to-day is made of small parts. Look at the adding machine, the typewriter, the phonograph, the dictagraph. Since there is no reason why the feminine hand cannot put parts into and take them out of the small machine tool, and with perfect ease turn its levers and keep it in order, woman is coming into certain kinds of machine shops as machinist on conditions not of equality but of superiority to man, so far as doing this particular work is concerned. In contrast to this, woman's clothing is a hindrance or prohibition for some kinds of work.

Child Labor.—There are thousands of youths of both sexes at work in American industry to-day. They are there solely because they work for little wage. The in-

evitable buoyancy of youth gives a frolicsome desire, and a heedlessness which means carelessness with material, need of much oversight, which is only offset by the lesser wage. A proper appreciation of the needs of our people should cause a much greater control than we now have over the kinds of jobs that boys and girls perform. They should not be allowed to work in places where they are not learning something. The boy who pulls an elevator rope and runs the car up and down twelve or fourteen hours a day is not learning anything that will be of value to him when he is a man. If he must be away from school, he should be, by all odds, in a place where he will get training that will make him of more value to himself and the country when he is a man. That was what happened to his grandfather fifty years ago when there was an apprentice system. He did drudgery, but it was drudgery from which he learned something. Many of the routine things which boys are doing could be done by old men who are past their prime, and not capable of handling a full-sized active man's work, yet who wish to do something, and who will not be injured by the fact that the work they do is not teaching them something.

When we have a school system better adapted to the needs of an industrial nation, this problem of the boy and girl out of school will largely disappear. They leave the school now often because it is not worth staying in. They say so, and they are right from their particular standpoint. Taking for a moment the standpoint of society, why should a couple of million children toil in factories while as many men are out of work—as instanced by average condition of 25 per cent. unemployment in the manufacturing state of New Jersey in the normal year 1912.

Classes of Workers According to Skill.—We may

divide workers into unskilled, intermediate, and highly skilled. *First, the unskilled worker.* The cheapest thing in the world to-day is muscle. It is made cheap because you can get substitutes for it. The traveller in Egypt, China, or Japan is amazed to see men standing and lifting water by various devices from a stream onto the adjacent fields to irrigate the crops.

They rarely get more than twenty cents a day for this work, and sometimes only ten. This looks like cheap labor. The facts are that it costs about $3 per horse-power day. A mechanical horse-power is a quantity sufficient to lift 550 pounds one foot in one second. When a man lifts fifty pounds a foot a second, he stops and rests a bit. Hence he is the most expensive of all forms of energy. The cheapness of mechanical power has caused us to eliminate unskilled labor wherever work is to be done in such large quantities that the process can be bunched or standardized and a machine utilized. For the handling of our crude material we have in nearly all cases been able to employ steam through elevators, endless chains, belt conveyors, chains with buckets, and cars running up inclined planes. Once the material is up, it usually goes down by gravity. Granted enough of a job of a uniform kind, and modern engineering skill is nearly always capable of the task of making machines do the work. Thus the mechanical ditch-digger, the dredge, the steam shovel, are doing work which generations ago was done by hand shovels, picks, carts, and wheelbarrows. Unskilled labor works only in places where demand for labor comes spasmodically or in small quantities or irregularly. This does not, however, mean that we have actually reduced the amount of unskilled labor. The digging of sewers, of foundations, still goes on largely by

hand for reasons above mentioned, and the great machines have merely enabled us to have so much greater wealth that we are supporting a larger population. Unskilled labor is declining *proportionally*.

The third class of labor is highly skilled. We are eliminating it in the same way that we are the unskilled, for several reasons. First, it is hard to get. The supply is always short, and if we can get some substitute we do so. Second, it is hard to pay, because wages are high. Third, a bit of the so-called artistic temperament comes in. It is hard to manage. Fourth, errors are costly. It requires imagination to be, for example, a pattern-maker of high class, or a high-class machinist. These men work from blueprints. They must look upon the flat paper, see the lines there, picture them in their minds as things with cubical content. Suppose a machinist makes a slight error in reading a drawing, sets the lathe accordingly, and cuts the piece of metal wrong. Mistakes of this kind sometimes cost hundreds of dollars. Hence the managers of modern industry are endeavoring to eliminate the work of the highly skilled man, and are succeeding just as they are succeeding in eliminating the unskilled labor by the substitution of machines easy to operate. The second class of labor, intermediate, is therefore growing at the expense of the other two classes.

Second-class Labor of Intermediate Skill.—The large part of the work of the modern factory is done by machines that are semi-automatic, such as those making screws and nails or those which need slight adjustment, such as the turret lathe, or those which may require considerable dexterity, but little time in learning. The great advantage of this kind of work is that so short an apprenticeship is neces-

sary. In a week a man can be taught to operate many of these machines. In that time he comes out of the class of unskilled labor to be a machine tender. Owing to the ease of reducing his simple job to habit, it is a matter of manual dexterity rather than brain work such as accompanies the work of the high-grade mechanic, who frequently changes from one hard job to another. This short apprenticeship means that the unskilled worker can, with a small raise in wages, take the job. It also means unfortunately that owing to the narrowness of his job he is dependent upon that concern and cannot move from place to place as could an all-round mechanic of a generation ago. Therefore he has less chance to bid for jobs and get increases in pay. Perhaps, too, he stays at a kind of job which is destructive of mentality and individuality, but this is a matter which the *sciences* of psychology and physiology and sociology have not yet gone far enough to test. It is to be hoped that they soon will be able to render us that service.

The Direction of Labor.—It is difficult for any man to superintend work that he cannot do. A factory where nearly all the workers are of the second class may have twenty kinds of workers, but no one in a position to supervise five kinds of work, because there is nobody who has ever done more than one or two. The old-time apprentice system took in boys and in a few years put them through all the work that an all-round mechanic would do. He could then boss any kind of work if he had the boss quality. We are in a period of scarcity of skilled mechanics with little provision for making them, and we are importing most of them from Europe. In the meantime the necessity for foremen has impressed itself upon manufacturers and there have been numerous attempts to devise suitable substitutes

for the old-time apprentice system. One is that which is adopted by a number of large firms in having classes of apprentices who are for certain lengths of time made to work at one process and then move on to the next, until at the end of a given period they have done nearly all kinds of work in the plant and are then in a position to become foremen and work up. (See account of Baldwin Locomotive Works in Chapter III.)

The Sandwich System.—This innovation in education has lately come from Europe, where it has been much more extensively utilized than in this country. The method is to have the student work for a time in a factory, getting actual practice, and spend an alternate period in a school getting the theoretical aspect of the work. Sometimes the students take six months in one and six months in the other, sometimes a week in one and a week in the other. This plan is working very successfully in the University of Cincinnati Engineering Schools, and has been much more extensively used in Germany and Britain. It doubtless has great possibilities in the United States in many lines of work where it is now untried. I expect it to advance.

The Object of Education.—This alternation of work and study is an admirable step in the process of making our schools fit us for life. In theory, of course, the object of the school is to fit us for life, but our conditions of living, our conditions of working, and the consequent social conditions have changed with such marvelous speed in these last one hundred years that the smartest of us can scarcely know where we are, whither we are going, or what we need. Consequently our system of education is a much greater misfit than that which is actually practised by the negroes in the villages of equatorial Africa. They have been there

long enough to know what they need for their particular type of civilization, and they secure it. We have no such adjustment to our environment, no such agreement of desire. Hence the multifarious clamor for this, that, and the other thing in education at this or that period of the child's life. There seems to be no agreement whatever as to what it is we shall teach. Each is speaking partly from his concept of what the environment is, and partly from the natural outgrowth of education he got in his youth, which, quite likely, was imported in Colonial times from England and is as great a misfit as is the vermiform appendix, which the anatomist tells us we still have within us because we once had a three-lobed stomach somewhat like a catfish.

Beyond a doubt, our education is rapidly moving toward the goal of fitness for the particular kind of life in which our people live. In this respect every manufacturer as well as every worker should be interested in, if not a believer in, the five objects of an education as laid down by Herbert Spencer in his epoch-making book on education.

First. The young person should be taught to avoid extinction by avoiding the dangers that menace his life, such as being run over in the street, eating poison, falling out of windows, and violating the rules of health.

Second. He should be taught to become self-supporting.

Third. He should be taught, if the capacity exists, to support and bring up a family and thus perpetuate the race.

Fourth. He should be taught how to participate in government, society, and the numerous relations which make up the State and maintain civilization.

Fifth. After all these prior necessities are met, there comes, if there is leisure left, the time for luxury, in which we may class what we call culture, the enjoyment of the

theatre, literature, pictures, travel, and all that goes to lift us from the mere drudge or the mere citizen. It is interesting, however, to note that the four above-mentioned classes have a more imperative call, and that higher education, which starts with number five, commits the offence that has been graphically described as "giving a man a champagne appetite and a beer-earning power." Unfortunately the American college was imported from Oxford and Cambridge—institutions made for the sons of the aristocratic rich, who had the first four objects of education guaranteed to them. The American college is now busily making itself over to fit American life or American needs, but such remaking must be slow and resisted at every step by the polished and personally delightful champions of the old.

CHAPTER XVI

The Man and the Job

What makes a man great as we measure greatness, and what makes him successful as we measure success? Perhaps the most important single element that would cover the largest number of cases we would pick out is the ability to understand and utilize human nature—our own and other people's. Very few persons attain great eminence by their own efforts alone. The eminent are mostly the heads of organizations, and it is largely through their own decisions that the staff or the organization is made. If a man does not know human nature, he will not be able to get good assistance, and his organization will not be able to get far. Mr. Andrew Carnegie is known throughout the world as its greatest ironmaster, possessor of the greatest single fortune ever made in this industry. Does that mean hard work on his part? Not at all. It means that he had the ability and imagination to see and create large plans and then the knack of getting good men to carry them out, whether he happened to be in Pittsburgh or fishing in Scotland. He has never been known in Pittsburgh for being an arduous worker, but he was able to pick out the men who could do the arduous work, and thus was built his great success. The success of a college president or baseball manager is identical with this.

Does the Man Like His Job?—Mr. Carnegie got rich because he had working for him men who were in the right place. This ability is important to the worker because we live but once, and if we do not like our job, our life is

slavery; furthermore, it is not a financial success. Very few people can do good work in a job they positively dislike. Liking our work is one of the elements of success with the work as well as one of the elements of success and happiness of life. A criminal is often a man who has failed to get into the right job, for we all have activity and we must use it, if not rightly, then wrongly. One of the best definitions of life is that it is the exercise of powers. If we get the right kind of job, we get into the place where we can exercise powers we have rather than let them atrophy. That is life. The opposite is death. Aside from mere torture, the worst punishment that can be meted out to man is to put him where he cannot work. The man-breaking punishment is not penal servitude at hard labor; it is solitary confinement with nothing to do. Its exact opposite is a position that lets us exercise all our powers. That we call life, full and rich.

The Purchase of Labor.—In every manufacturing plant with one hundred people we really have many kinds of jobs, many kinds of work, and should have many kinds of workers. Are the right workers and the right jobs brought together? If so, at the present time it is largely a matter of chance In many plants each foreman can do his own hiring. In fact, the employer thinks he has reached the supreme limit of good arrangement when he tells the foreman he has the right to hire and fire. There may be thus twenty employment departments in the works. The community would be scandalized, and the stockholders probably would be heavy losers, if these twenty foremen bought the coal, iron, wood, cloth, machinery, etc., for their particular departments, and the plant would be ruined in a short time, or at least the good name of the company would be.

Yet these men are in a position to buy the labor, a task for which they are perhaps no better fitted than to buy the other materials of the plant. Probably they are less fitted to do it. There is therefore a movement in America to extend the idea of specialization to having one person do the employing and the discharging. Thus we get away from the gross evil effects of the rule that a man once discharged can not be taken on again after Department A has fired him, even though he would be good in Department B. Furthermore, by having this matter specialized, we have good opportunity to get employment put upon a business rather than sentimental basis. When each foreman can hire, men are often hired through pity, or because they can bribe the foreman, or because they belong to his church, his lodge, his nationality, or are his friends. Is not blood thicker than water? The hiring of a man is a matter of investigation just as is the buying of a machine, and if he is hired on that basis it is much more likely to be satisfactory to all parties, including the balance sheet, than if hired because of a bribe, or of pity, or of creed, or of friendship.

What Does the Job Require?—Before we can pick out a man for a job, we must know what the job requires. How many employers actually know the real requirements of their work? Perhaps a foreman says he wants accurate men, but also says he wants speedy ones. Yet the accurate methodical man is inevitably a slow man. Accuracy is made largely of slowness. The executive often likes to surround himself, naturally, with persons like himself, yet he may have four or five kinds of work that require four or five kinds of men. If a young man therefore fails, is it his fault, or the fault of the man who hired him and put him at the wrong job? As an example of lack of requirements for the job, the story

is told of a firm that was needing an advertisement writer. A man high up in the firm happened to meet in a Pullman car a man who had read all of Shakespeare and Dickens and talked very interestingly. He forthwith engaged him to be an ad. writer for the firm, telegraphed back to the eastern city to stop searching for a man, and the fellow actually left his job in a western city and came East. It was impossible for him to resist the impetuous assurance that he could do the work at a salary twice what he was getting. The result was a grievous failure, because a bookworm is not an ad. writer, unless it is by a marvellous concomitance of accidents.

Job analysis is a part of the hiring of men. So is man analysis.

What Qualifications Does the Man Have?—No two men are alike. Then how can we find out anything about them? There is, fortunately, the very considerable possibility of determining things about a man, and this is a field of study in which we are likely to have rapid progress, to the great benefit of both workers and employers. There are already two methods actually in use to some extent. One we may call the laboratory test, and the other mere external observation. Both depend upon the idea of psycho-physical correspondence. This idea has its roots in the notion that mental or psychological conditions have a physical basis Thus a clot of blood on a man's brain will paralyze a hand or an arm or make him unconscious. The clot is the physical, the unconsciousness is the psychical aspect of the psycho-physical correspondence. Similarly a man who can hear music has certain physical conditions in his brain and nervous system which the other man who cannot hear music lacks. If we could observe closely enough we could doubt-

less detect some physical difference between the musical and the non-musical. However, we do not have to be able to detect the exact things which make us musical or otherwise, because other tests can show whether we have the ability or lack it, although the machinery that gives us that ability may be entirely hidden within our craniums. If every one of our aptitudes was as easy to test as that for music we could be catalogued like shoes in a shoe store.

The Laboratory Test.—The best known and most scientific method is the laboratory test, such as examining a man for color-blindness. The motorman, the engineer, and the navigator must be able to detect color signals. About 4 per cent. of us cannot tell yellow from green. Suppose we look down the track and see yellow when it is green, or *vice versa*. A thousand color-blind locomotive engineers would in a night turn America into a nation in mourning. Therefore locomotive engineers have been tested out, and color-blind men are left for other work where ability to distinguish color is not important. Similarly, tests can detect in a moment whether a man has a musical ear or not, whether a good ear or a poor one. Certain simple laboratory tests, even with the little finger, can give some measure of a man's endurance. Apparatus shows the character of our response to sense impression. The telephone girl is judged by the quickness of her eye and hand. How long does it take her to get a signal and make the necessary connections? That is a matter of test. It is also a matter of test as to how many mistakes she will make in a certain number of calls. Professor Munsterberg, of Harvard, is attempting to show, by a test requiring the checking of certain letters in a certain kind of newspaper column, that there is a direct relation between the number of errors made and the ability of

the individual undergoing the test to become a successful switchboard operator. If such tests could be evolved for all kinds of work it would be a relatively simple matter to eliminate, without actual trial, all individuals who could not succeed in particular positions. This would be a boon to workers and hirers. These examples indicate a wide field in which vocational fitness can in all probability be studied. It is a field of work well worthy of heavy endowment for its rapid exploration. For some account of the beginning of this work, see "Psychology and Efficiency," by Hugo Munsterberg.

Physical Observation.—Physical observation as a means of man-testing has perhaps been best discussed in Dr. Katharine Blackford's book, "The Man and the Job," published by the *Review of Reviews*, New York. She has picked out nine variables about a person which can be noted in two minutes as he walks into the room, sits down at a table, and fills out an application blank. Dr. Blackford makes the point that a man is not tall or short, light or dark, small-nosed or large-nosed, by accident. He has each of these qualifications from his ancestors, and they, in their turn, got them because they were essential to success in some environment, just as the claws of a squirrel are essential to his success in the woods where he must climb trees.

First variable—color. Why is a man light (blonde) or dark (brunette)? The brunette has pigment in his skin. Pigmentation seems to be nature's method of protecting man from light. The greater the light in which he lives, the greater the pigment. Thus the negroes in the treeless parts of Africa are almost as black as ink. Negroes who have lived for long periods in the dense shades of some of the forests in Africa are nearly white. Caucasians living in sunny India

for thousands of years still have fine hair and straight features, but black skin. So the Eskimos who live in the glare from the Arctic snow have yellow skin. The American Indian also has a colored skin. The tow-haired blonde is a product of northwestern Europe, where for weeks at a time the sun is never seen because of the mists and fog and clouds that arise from contact of the Gulf Stream winds with the colder continent of Europe. There nature did not have to protect man from the sun by giving him dark skin, as she had already given protecting clouds. Therefore in the course of time the race developed the high blonde, and if the high blonde goes to the tropics he degenerates more rapidly than other kinds of people, according to the latest investigation of science, on account of the deleterious influence of light upon his organism, which cannot protect itself from the light. The fact of blondness therefore merely means that a person came from North Europe, which is an environment where it is hard to make a living. Therefore he has had to work, has had to be energetic. It practically means he is a man of the North. I have never been in a country that extended through 300 miles of latitude where I did not find a strong belief that the people of the north were more energetic than those of the south. It is admitted in both ends of the United States; people of South Portugal say that those of North Portugal are much better workers; employers in South Italy say the same thing about the Tuscans of North Italy, and farmers in South England like to get the North countrymen for farm hands because they are better workers. These are merely examples illustrating the fundamental reasons as covered by the blonde. He has long since got the work habit, the energetic, resourceful habit, initiative. He has dash and go, from living in a

region where these things are most essential to his continued existence. How do these things relate to the job you have to fill or the job you seek?

The brunette, in contrast to the blonde, has been produced in regions of much light. This condition prevailed where the glaring snow of the Arctic region has given the Eskimo a dark complexion, but he happens never to have emigrated to the regions of industry, and therefore, for that reason, has not been considered. If he did, according to what we know of him he would undoubtedly fit in with the blondes, who are also a product of the North. Most of the brunette races of the world have been produced by high light which comes with much southern sunshine. The higher the light the darker the color. Therefore they are products of the South, of warmer climates, or regions where nature is more productive, where it has not been so necessary for initiative or energy. As a matter of fact, their pulses are slower; their vital processes are therefore less vigorous than those of the blonde. Their digestions are usually not so good, because of the greater regularity of southern food supply.

In work they tend to have less initiative, to be conservative and to be theoretical rather than practical, which is the adjective we so invariably apply to the Germans, the largest group of the blond type. As a fine example of the theoretical in contrast to the practical turn of mind, there is a story which I have only at second hand from a Russian general in the Japanese war, who went forward with some of his staff to inspect a stream which they had to cross. The engineering corps assured him a bridge could be built in three days, and would be built in three days. At the end of three days the general returned with his army to the river and found the members of the engineering corps

divided into two groups and engaged in a heated discussion of the theory of the arch—with nothing at all done on the bridge—a fine illustration of the triumph of the theoretical over the practical. It is surprising how some of the brunette races can indulge in just such theoretical discussions when the thing that is needed is achievement, some practical solution rather than discussion of the many ways that it might be done.

Form.—A superficial examination of a man shows at once that he has a certain form of nose, of forehead, of mouth, and a general type of face, either concave or convex. The flat nose of the negro, with large, round nostrils going by the shortest possible route into the throat passage and lungs, has sufficed to admit large amounts of tropic warm air in breathing. When he strikes zero weather, large masses of cold air injure the throat and lungs and give the negro great tendency to pulmonary affections, which the man of the North has avoided by developing longer, more curved air passages through a long, high nose with thin channels through it; namely, a heating plant. Therefore, such a nose is an indication, like blondness, of northern ancestry, and is found alike on the Turk who has come from North Central Asia and on the American Indian of North Central United States, as well as on the peoples of North Europe. It means positive energy. Its opposite is a short turn-up or pug nose. Any person studying in this field should on all occasions remember that judging a person by one feature is most risky. We are a blend of many qualities.

Forehead.—We have recently invented the term "high-brow," which probably applies to the head which has a forehead protruding at the upper part, in contrast to the long backward slope with a tendency to prominence over

the brows. The common use of the word "high-brow" in semi-slang has reference to a person who is interested in abstruse, philosophic, abstract, or at least non-practical knowledge. The better way to put it might perhaps be to use the word "meditative." The person with sloping forehead, on the other hand, tends to be matter-of-fact. He will handle material things naturally with ease, whereas the meditative type likes to think about them. The latter revels in thought rather than action. He writes books, he teaches. His product is ideas, not things.

Chin and Mouth.—Fiction is full of references to the square, strong jaw. We instinctively recognize the small retreating chin as a mark of weakness, morally if not otherwise. The races of the tropics do not have large chins or strong jaws, because for ages they have lived largely on such soft food as bananas, sweet potatoes, yams, breadfruit, fish, none of which need much chewing. Hence their teeth are not firmly set in the jaws, their jaws are not big, and their mouths therefore protrude. In contrast, the people of the North have lived on nuts, tough meat, and have had much chewing to do. To this day Eskimos do a great deal of their leather tanning by chewing the skins of animals. A strong jaw has been necessary to survive, so it, like the large nose and blonde complexion, is a sign of a northern past, with all that it involves in firmness, strength, energy, and aggression.

Form of Face.—The concave face as seen in profile is a mark of non-aggressive good-nature. The convex face indicates impulsiveness, lack of tact, and a tendency to start many more things than the strength permits the person to finish. Kaiser Wilhelm of Germany has such a profile.

Structure.—People fall into three very pronounced types with regard to structure, a characteristic shown by looking a man directly in the face. Dr. Blackford divides them into three types: mental, motor, and vital.

The *mental type* tends to have a pear-shaped head, big end up, because of the large development of brain and slight development of the lower part of the head, and similarly a rather sparse development of bony structure. Such a person has his great gift in brains, and is happy only when they can be exercised. Remember, that one of the best definitions of life is the exercise of powers. This explains why the most fearful of all punishments is to put a man in a cell with nothing to do. We deny him the exercise of powers. We deny him life; he suffers fearfully and usually goes crazy. Therefore people tend to be happy when they are utilizing their most pronounced characteristics, and so this person of the mental type with the large brain is happy using it. If put where he has to do hand work, he chafes, hates to work, and therefore does not do well. If he is of the creative type of mind, he has an abundance of ideas that other people ought to have, and plans what other people ought to do. For example, Ben Lindsey, a pronounced type of this sort, spends part of his time straightening out small boys who are in trouble, showing them the path to follow, and seeing that they follow it. He has made good men out of many wayward boys. The rest of the time he travels around giving lectures, and telling us numerous things society must do to readjust itself to meet modern conditions. His product is ideas, plans.

If the mental type has less originality, he makes a high-class clerk who thinks over and over the results of ideas of others, but still avoids hand work.

o young men appeared at my office to apply
rative course. Although they came together,
.icquainted, one being from Kansas and the
:ere of the same physical build; they had the
.ics; their scholarship records were equally
y felt an impulse toward mechanical engineer-
good material. The conversation disclosed no
differences in their personalities. They gave
ɔod 'pair,' and consequently were sent to the

· of events, a coördinator from the engineering
·· machine shop. The foreman said Kansas was
'hio didn't get into the work. Each time the
the foreman reported Kansas as most satisfactory
and more unsatisfactory. In a month Kansas was
:ork with the ease, sureness, and dexterity of an
'hio was getting a case of nerves, spoiling work and
ue. The superintendent asked us to try Ohio else-
.ecided, for a number of reasons, to continue him in
longer.

niversity, however, Kansas was soon reported to my
ly hopeless. His scholastic grades were almost zero in
.s. He gave no reactions at all in class and laboratory
.chers said he was stupid. But Ohio came to his school
ctivity. He was mentally keen and seemed to delight in

.s grew nervous over his school work, Ohio thrived on it.
school was tired out at 10.30 each morning; Ohio got
e hours went by. Kansas longed for the rest which shop
him; Ohio longed for the rest which school work gave him.
ts and conference showed conclusively that Kansas broke
al work, mental responsibility, and self-directed and diver-
ual work, but that he expanded in spirit, health, and satis-
der repetitive shop processes which were planned for him.
sts and conferences showed that Ohio broke under the strain
l repetitive processes, and to a lesser degree under self-
nd diversified manual work, but that he thrived when given
oblems and responsibility.

have lost track of Kansas, but Ohio is happy and successful
rcial life."

The *motor type* man tends to be square physically with a square head rather than pear-shaped. He has great bony, muscular, and nerve development, he yearns for activity, writes books on the strenuous life, can't sit still all day without great discomfort. He must move about. That he should run things is one of the most natural of results. These men are athletes, cheer leaders among college students; they are soldiers in command, they are captains of industry. They put something through. Perhaps they get an idea from a man of intellectual type, and then with consummate ability drive one hundred or a thousand other men to its execution. Thus Secretary McAdoo, a good type of the motor man, put tunnels under the Hudson River, huge skyscrapers over their terminals, rode up and down twenty stories in the air on iron beams, and clambered over the works as do generals in command of armies. Such men can not sit at desks.

The *vital type* man has an oval head tending to be pear-shaped at the lower end, with strong tendencies toward a double chin. They are *strong on digestion*. The face of ex-President Taft is a clear-cut example. Moving about is not particularly pleasant to such men. Having strong digestions, they like good food, having big intellects in their oval heads, they are strong at meditation, and they like other good things than mere food, so tend to be acquisitive. Liking good things, they can interest other people in them, and so the less effective men of this type we find behind the counter selling good beefsteak and foods, or as bakers making good pies and cakes. We have all seen the fat bakers and the fat butchers. Notice the heads of the next half dozen you see. With greater development of the thoughtful power, they make excellent judges, because they are calm, can sit a long

while turning over facts, and think the thing out to some definite conclusion with the evidence in hand. They can lay down the law.

Another variety of the vital group is the financier, who sits and mulls over plans, reasons out conclusions from the premises, and makes decisions which make his bank a great bank. President Vanderlip, of the National City Bank of New York, is a very pronounced type, so is his predecessor Stillwell, so are many other great financiers. Such a man can sit still and work over details or ideas. It would never do to put him where he had to exercise the power of the motor type, but if connected with the man of the motor type great things can result.

Texture.—Under this heading Dr. Blackford points out the fact that certain persons have a coarse appearance indicated by the size of features, character of hair and skin. The converse have soft hair, smooth skin, finely-chiselled features which we all recognize. Put the finely-chiselled man at coarse labor or manual work, and he is unhappy. Give him jewelry and fine things to fashion, and he fits. The converse tends to be true.

Consistency.—By the mere shaking hands with a man we recognize the hard, unbending grasp, the firm, elastic grasp, the soft, flabby grasp which causes so many people to shudder instinctively.

One important point in considering a man for a job is this: when a man has a characteristic, he nearly always has it clear through. The quality is not stuck onto the man like a wart may be stuck onto his nose, disconnected from the rest of his body. If his hand-shake is flabby, flabbiness is a characteristic which will come out in more ways than the hand-shake. His morals tend to be flabby; that

is to say, if tempted, he will be good if there are good men around him, and bad if those around him are bad. He actually even gets sick easily and diseases tend to become chronic. The man with the unbending hand-shake is hard to unbend in business relations. You can take him for what he is, but don't expect to change him too much. He can't stand it. He will break first and quit.

Condition.—This same idea of qualities running clear through a man means that carelessness in dress is not an isolated fact. The man who is careless in dress is prone to have business laxity. Perhaps he may have other qualities that compensate, and he may be desirable, but he will furnish the element of business laxity.

I do not mean to give any impression that this discussion of the qualities of men is complete. I present it rather to indicate the fact that there is a very important field upon which we are beginning to gather knowledge, and it is alike important to those who employ and those who are to be employed. If you can walk into a group and form some impression of the persons you meet there, you have some knowledge of what you can do, and certainly it is in accord with other human experience that you should have more knowledge of those people if you have studied the matter somewhat, than if you had merely trusted to your instinct.

The University of Cincinnati Engineering School has for a number of years been having students alternate between class-room work and shop work. This gives an unusual opportunity to study variations of personal equipment. The importance of knowledge of this in connection with work is well shown in the following story told by Dean Schneider of the Engineering School:

"Several years ago two young men appeared at my office to apply for admission to the coöperative course. Although they came together, they were not mutually acquainted, one being from Kansas and the other from Ohio. They were of the same physical build; they had the same facial characteristics; their scholarship records were equally good, and both said they felt an impulse toward mechanical engineering. Both looked like good material. The conversation disclosed no radical or even slight differences in their personalities. They gave promise of being a good 'pair,' and consequently were sent to the same machine shop.

"In due process of events, a coördinator from the engineering college called at the machine shop. The foreman said Kansas was satisfactory, but Ohio didn't get into the work. Each time the coördinator called, the foreman reported Kansas as most satisfactory and Ohio as more and more unsatisfactory. In a month Kansas was turning out his work with the ease, sureness, and dexterity of an old hand, while Ohio was getting a case of nerves, spoiling work and developing fatigue. The superintendent asked us to try Ohio elsewhere, but we decided, for a number of reasons, to continue him in the shop a little longer.

"In the university, however, Kansas was soon reported to my office as utterly hopeless. His scholastic grades were almost zero in all his subjects. He gave no reactions at all in class and laboratory work. His teachers said he was stupid. But Ohio came to his school work with activity. He was mentally keen and seemed to delight in his work.

"Kansas grew nervous over his school work, Ohio thrived on it. Kansas at school was tired out at 10.30 each morning; Ohio got better as the hours went by. Kansas longed for the rest which shop work gave him; Ohio longed for the rest which school work gave him. Careful tests and conference showed conclusively that Kansas broke under mental work, mental responsibility, and self-directed and diversified manual work, but that he expanded in spirit, health, and satisfaction under repetitive shop processes which were planned for him. Similar tests and conferences showed that Ohio broke under the strain of directed repetitive processes, and to a lesser degree under self-directed and diversified manual work, but that he thrived when given mental problems and responsibility.

"We have lost track of Kansas, but Ohio is happy and successful in commercial life."

The whole question of the fitness of the man for the job brings up the question of hiring and discharging to an importance before unappreciated.

Getting the Man for the Job.—Certainly, wherever there is any large number of people to be employed in a works, it is a legitimate extension of the century-old idea of the division of labor that one person should do the hiring and the firing, and apply special knowledge to the task. The establishment of such a department will at once lead to the discovery that every foreman has his qualities which demand recognition in the placing of men under him. For example, the driving, energetic, domineering, bossy kind of a boss will almost invariably come to conflict with the same type of man as a worker under him. The sparks fly and something has to break. On the contrary, many persons of the quiet and retiring makeup do not particularly mind the bossiness of the boss. They may perhaps rather like him because of the well-known fact that opposites tend to agree. The writer of "Mother Goose" was touching a great truth when he wrote the verse about Jack Spratt and his wife.

The employment department at the present time, for example, would be tending to breed trouble by putting Germans under an English foreman, or *vice versa.* There are well-known international affinities, and international antipathies which tend nearly always to rise when people of certain nations are put together. An adequate employment department would recognize all these things and very soon shift the workers from one department to another when friction arose from personal causes that lay in the facts of human nature. A careful employment department, knowing something of the demands of particular jobs, as well as

the capacities of men, can do much to bring the right man to the right work.

Discipline.—It is an unfortunate fact that wherever large numbers of people are at work in an organization some form of discipline is necessary for efficiency. Here is a plant with twenty foremen, each with ten to twenty men. Who shall discipline the men under a certain foreman? Shall the foreman who sees the offence, who has perhaps been offended, decide what the punishment shall be and inflict it? He is thus in the position of witness, judge, jury, and executioner. In the development of English and American legislation, such concentration of power was found out centuries ago to be a great evil, and many generations of men strove to establish trials for civil and criminal cases whereby the same man was not witness, judge, jury, and executioner. Instead, a man was tried by a jury of his peers, who had had no part in the controversy in question. So, in industry, one of the points that has been clearly insisted upon by scientific management is that discipline is a function to be attended to by a specialist, just as is the buying of labor and the buying of coal and selling of the product. Therefore a large plant needs a disciplinarian who may have jobs, too, but he is a disciplinarian, just as a community has in its courts a group set apart for community discipline.

The first of all cures for the erring one in the factory is, naturally, talk. If the presentation of the fact suffices, well and good. There are certain people, however, who have to feel something stronger. The well-known devices are the reduction of wages and the laying off of a man for a time. If the *wages are reduced,* a man has great difficulty in seeing the matter in its purely disciplinary light.

It tends easily to violate one of the fundamentals of discipline. A man should be able to see that the punishment he gets is just. This is difficult, but if others also get it, when he cools off it may seem just to him. But if the firm reduces a man's pay and gets the money, there is no way of removing from his mind the suspicion that the reduction was made perhaps because of discipline, perhaps to keep some money in the firm's pockets. That idea is ruinous to discipline.

Laying off of the worker, a well-known device of railroads, is clear of the above-mentioned suspicion, but is manifestly a waste of productive power, and in times of pressure of work it is almost impossible to lay off men without even greater loss to the firm than to the men themselves. Therefore the tendency is to avoid this kind of discipline.

Bad marks are a preliminary device to reduction of wages or laying off. Some firms give for mild offences a mark or demerit. When a man gets a certain number, something happens. This demerit system is a kind of temptation to a man to see how many he can get and not get over the line. It corresponds to the temptation of boys to skate on thin ice.

Fining, if properly applied, avoids all the above-mentioned difficulties and still leaves the man with a clear-cut impression that he has been punished. But *fining* will never avoid all these evils if the money taken from the man goes to the firm. The money must get back to the men. Then they are sure the firm is not making money out of them. A man who has made an infraction of the rules contributes a set amount to some fund, such as accident or sickness benefit fund. If everybody, from the general superintendent to the office boy, is occasionally subjected to these fines, a sense

of justice tends to accompany the system. If it goes to the accident rather than the sickness fund, there is less chance of discontent, because it is easy to sham sickness, but very hard to sham accident. Sickness tends to be a matter of opinion, accident is largely a matter of fact.

Esprit de Corps.—This is a French word meaning the spirit of the corps, showing its derivation in armies. It has been defined by Mr. Hamilton Church as the synthesis of good-will of a group. Its very title, the word "spirit," indicates the difficulty in giving a good definition. Perhaps it would be well to call it team work plus pride of the group. It is a fact that man tends to be a gregarious animal, namely, one that goes in groups, and along with this habit is the idea that the group to which we happen to belong is a superior group. We all feel that members of our church are a little better than those of the next church; that members of our lodge or club are superior to members of the next lodge or club; that our class in school is better than the class above or below us that the people of our nation are not only different from, but better than those of any other. The word "barbarian" is merely descended from the Greek word for "foreigner." We tend to say that persons of other religions are heathen. Therefore the *esprit* primarily has its origin in this tendency of men to have group pride, and nearly all successful institutions have something about them, some spirit about them which arouses group pride, willingness to serve the group, push it forward, promote it, stand for it.

Popular generals have the power of making men have great faith in and love for their armies and divisions of the army. Napoleon Bonaparte is reported to have said, in a moment of reminiscence at St. Helena, "The Second brigade

would have died to a man for me, for did I not say in the bulletins from Lodi that I was at ease, for the Second was there?" That gave the members of the Second at least the notion that they were better than the First or the Third. Hence, as would many another group of soldiers, they would have died to a man for the general who had called on their group pride.

The Development of Esprit de Corps.—Where men are working under the threat of being fired, they are not developing *esprit de corps.* To this they must be led, not driven. They must have faith in the purposes of the group, they must feel that they are working under a spirit of justice, must feel that they have a place in the group, and that their services are going to be recognized. One of the ways to develop faith in the purposes and success of the group is to give the workers in an enterprise reports as to its progress, such as a map showing the territory over which the product is being sold. Pictures showing the transportation of the goods on the backs of elephants in India, or the backs of camels in Asia, or mountain-climbing mules in South America, tend to create in everybody in the works a real interest in the product, even if the actual goods were made a block away from the place in which the individual works. Does not every student thrill with pride when he hears of some honor that a member of his school has won? Does not the American or Frenchman or German or Englishman warm with a sense of pride when he hears of some honorable or generous deed by a fellow-countryman whom he perhaps has never seen or heard of? That is group pride, the stuff that *esprit de corps* is made of, a very intangible thing, but beyond a doubt a tremendous factor in making men and material effective.

It is capable of being utilized not only for a large group, such as one comprising all the employees of a single great establishment, but also for the various divisions within the group. Its utilization has been called by Mr. Church a scientific utilization of gossip. Here is a power plant with four or five men. In their odd moments what will they talk about? Shall it be baseball or boilers and power plants? Manifestly they are going to think a lot more about their work if their attention is much on boilers and little on baseball. Therefore comparative data of the amount of power turned out, the amount of coal used to produce this week's output in comparison to that produced last week, facts about the power plants of other concerns, facts about power plants and their operation in general, tend to make the men talk and think about their work and thereby get a pride in it, which pride makes men enthusiastic. Therefore enthusiasm is not *esprit de corps,* but one of its results and tools. So is co-operation. *Esprit de corps* makes men cooperate to an end.

The fact that students of scientific management are beginning to give much attention to *esprit de corps* and the contentment and condition of the worker is a natural back swing of the pendulum from the merely material and intellectual developments that have followed the great inventions of machinery and new plans of organization. Those are material things, but man is an emotional animal, and *esprit de corps* is one of the industrial phenomena that shows that fact.

CHAPTER XVII

Standardization in Labor

A previous discussion of standardization was limited to standardization of pattern and product, and certain economic aspects of production. The speed and method and conditions of work are fields in which there is also a great need for standardization, and here is a place for great service to be rendered by it. Frederick W. Taylor, the man best known in all the world as an exponent of and pioneer in the development of science in work, or scientific management, laid great emphasis upon the ignorance of the American manufacturer with regard to the possibility of his men and his machines.

What is Standard Performance?—What is a fair day's work, a fair hour's work, for a horse, a man, a girl, or a machine, at any of the many things they do? How long does it take to do a particular thing? The facts are, we mostly do not know, and if we know how long it does take, we often do not know how long it should take, for there is a great difference between actual practice and best practice. We have here great ignorance and great possibilities of increased efficiency through increased knowledge which shall result in the introduction of standards. For example, it is a fact that the manufacturers of many kinds of machines in the United States do not know within 50 or 100 per cent. or even 300 per cent. what their machinery should and can do. They will assure you that it is as good a machine as their rivals make, and point out the features of physical excellence, but the real scientific test as to what

it can do in given conditions has rarely been made. The same thing is true, also, of human labor. This brings us up to Mr. Frederick W. Taylor's great contribution of time study.

Time Study.—It is to Mr. Taylor that we are indebted for an entirely new field of knowledge and an entirely new method of work in this field. Of course it has been known for ages that men would do a certain piece of work in a certain length of time, but that is not the time study as Mr. Taylor applied it. He analyzed work into its lowest possible physical elements and took the time of each, so that he had irreducible units—"unit times" he calls them—which bear about the same relation to the old-fashioned time-taking that a brick does to a house. Bricks make the house. Unit movements make the piece of work. The architect studies house plans, thinks in terms of bricks, and so Taylor, who might be called an architect of work, applied to it an analysis which reduced it to its lowest terms.

About how long does it take a man to move a cubic yard of dirt? That is a very complex thing. How long does it take the man to fill his shovel? How long to lift it to the wheelbarrow? How long to move a wheelbarrow a yard or a foot? These are the real units. With these units people can plan work just as now with bricks as units of thought an architect can plan a house. Some of Mr. Taylor's earliest work in this line was done in the studying of men who worked at loading pig-iron, shovelling ore, shovelling coal, and from the knowledge thus gained improvements were made and standards were set. They knew what tools were needed, what speed a man should make, how much of a given kind of work he should do in a given time. The application of the results of this time-study knowledge greatly in-

creased the speed of the work without applying any injurious rush to the workers.

Mr. Taylor insisted this same thing should be applied to all work so that we can have definite standards as to what a man can do. Then he cannot "soldier." The idea is good, but it at once raises the question of what kind of motion we shall study.

Motion Study.—Plainly it would be very unwise to study and standardize the motions of an awkward worker. Therefore we need to study motions first, and here we have in Mr. Frank Gilbreth, of Providence, R. I., the pioneer in this large field of investigation. His work brings to our notice this astonishing fact. At the present time the authority for the way to do work is usually an unskilled worker. Each man is allowed to attack the proposition for himself, and our old notion that every individual is going to get the best method is really ridiculous. No one would think of handing over fifty typewriters to fifty green hands, and telling them to go ahead and learn. We know that much study is required, that we should go through much exercise, using certain fingers on certain keys, learning in a certain way, so that we shall be able to use the proper fingers in the proper way to get the best speed. Fifty green beginners would have probably forty or fifty methods, of which not more than three (if any) would be the best. The rest would never attain scientific dexterity, using one, two and three fingers, rather than five. Yet very few of the learners in the trades of the world to-day have any best way shown. They go ahead and work it out. There are one hundred ways of doing nearly any kind of work, and of these ninety-five to ninety-nine are wrong. Mr. Gilbreth therefore says we must study every trade and each piece of work, and find out

the best way to do and the best way to learn to do it, just as we have done with learning how tó run the typewriter. In this process of motion study he brings us to the rather appalling fact that there are fifteen variables for the worker, fourteen for plant equipment and tools, and thirteen for the motion itself, a total of forty-two, each one of which must be properly adjusted before we make possible the maximum of efficiency by the worker.

As an indication of the scope of the work, I will mention a few of the variables. One is *contentment* of the worker. Nearly all of us have had the experience of going to our work in the morning feeling good, and then some harassing disappointment comes. We forgot our lunch; we forgot some memorandum or plan. We lost something, or somebody made an unpardonable blunder. Things are thrown out of gear. We are worried, and in ten minutes have a sense of headache or fatigue, which would not have been produced by an hour or two or three of hard work. This is true in all grades of work. Is the man satisfied, or in conditions which make him discontented? Discontent means that he has less energy for work; consequently, efficient management must keep people contented.

Creed.—Under this title Gilbreth discusses factors which are very close to the point of *esprit de corps* discussed above. He says if a church is being built men will work on it better if they happen to be members of it, or are in sympathy with that church. If men of three or four nationalities or churches are doing the work, they will do far better if divided into separate groups, rather than if left together. The Poles will try to do more work than the Irish or the Italians, or *vice versa,* if in groups, whereas if together, there would merely be hard feelings between them.

List of the Variables.—From Frank B. Gilbreth's "Motion Study."

Variables of the Workers:

1. Anatomy
2. Brawn
3. Contentment
4. Creed
5. Earning Power
6. Experience
7. Fatigue
8. Habits
9. Health
10. Mode of Living
11. Nutrition
12. Size
13. Skill
14. Temperament
15. Training

Variables of the Surroundings:

1. Appliances
2. Clothes
3. Color
4. Entertainment
5. Heating
6. Lighting
7. Quality of Material
8. Rewards and Penalties
9. Size of Unit Moved
10. Special Fatigue-Eliminating Devices
11. Surroundings
12. Tools
13. Union Rules
14. Weight of Unit Moved

Variables of the Motion:

1. Acceleration
2. Automaticity
3. Combination with Other Motions
4. Cost
5. Direction
6. Effectiveness
7. Foot-Pounds of Work Accomplished
8. Inertia and Momentum Overcome
9. Length
10. Necessity
11. Path
12. Play for Position
13. Speed

Fatigue.—This point goes with the matter of content, only it pertains to physical rather than intellectual and spiritual factors. To the altruist a new note of human

kindness in the study of scientific management is one of the most refreshing things. It is not long since those persons who were urging the claims of comfort and decency in the world were regarded as cranks calling on business men to make unprofitable expenditures of effort and money. For a time it was Society for the Prevention of Cruelty to Animals which was urging decency for beasts. Now professors of dairy husbandry tell us that a cow will not give milk most profitably unless comfortable, warm, well-fed and contended. She must not be scared. The same is true with the hen that is going to lay eggs. The same is true with the man who is going to do work. Similarly it was the old idea that physical discomfort about the plant was a matter which the men had to stand. It was their lookout, their loss, and not the company's. Now comes Mr. Gilbreth, with his motion study, and he assures us if a man is subject to discomfort, it tires him quickly. A man stooping over to pick up bricks can do it more easily if he has something to rest his hand on. Since he does it more easily, he can do it oftener, and he can therefore lay more bricks in a day. A careful study of size of packets shows there is a point above and below which we have diminishing returns. If a man must carry bricks, shall he carry two weighing fourteen pounds, or twenty weighing one hundred and forty pounds? Plainly, both are wasteful figures. We must discover the size of the packet which gives the maximum of efficiency for an average man. Below that, numerous trips reduce the output, and above that, excessive weight reduces the output.

Closely allied with this is the question of rest. The old idea was to drive men, and, if their backs ached, drive

them anyhow. The new idea shows that fatigue is a poison, which must be eliminated by rest. If tired, the driven man goes so slowly that it amounts to rest. Experience in marching men long distances shows that definite portions of time devoted to rest will get them farther in six days than if marching from sunrise to sunset. So one of the important things in the new scientific management is the determination of the proper time to be given to absolute rest. It depends, of course, upon the heaviness of the work.

Mr. Taylor delighted to tell personally, if not in print, some of his achievements in the moving of a large amount of earth in the building of his house. Local contractors gave a certain figure per cubic yard for moving earth from one point to another. Mr. Taylor thought it high. He hired ordinary teams, plows, scoops, men, etc., by the day. They were put to work. They went down with a load and came back for another. At certain points clerks held up the men. They demurred, they didn't want to rest, they were hired to work, but the point was carried. Then they went on with renewed energy, and the dirt was removed at costs previously unheard of in that locality.

Nutrition.—Is a man's dinner-pail well filled or not? The old idea was that that was his own stomach-ache. A study of managing soldiers as well as men at work shows, however, that the well-fed man can often do 50 per cent. more than the ill-fed. How much can a firm afford to pay to get good food into a man for whose time they are paying $1.50 a day, if it is going to make this 50 per cent. extra output? Plainly, they can afford to board him, and many a firm has, in recognition of this fact, actually

bought good food and sold it at less than cost to guarantee that the men were properly fed.

Color.—All these above-mentioned examples are variables of the worker. As an example of the discussion of variables in surrounding, equipment, and tools, I will cite color. We often need to make some mark designating that a certain thing shall be done with a certain piece of material. How shall it be worked? Suppose we put up a sign to be read. A person looks at it, detects the difference in color, then the form of it, then translates the letters into words, and the meaning of the words is thought out. That is a long process in comparison to taking a glance and noticing that this end of the brick is red or white, with cheap paint or whitewash. The colored end goes inside. The fact can be grasped in a shorter time than by reading the sign. Manifestly this principle of labelling with some color rather than reading can be duplicated in numerous ways which simplify mental processes, enabling a man to grasp the thing he needs.

Tools.—What is the best shovel to use? The fact is, a man regularly lifting a load has about a certain weight as the maximum of efficiency. Shall the workman bring his own shovel? In some places he does. If so, how many shovels should he bring? Why, one, of course. Perhaps it will attain the maximum if he shovels sand, but if he shovels iron ore he may get too much. If he shovels coal or coke, perhaps he will get too little. Plainly, many kinds of shovels are required, and plainly, therefore, an employer cannot afford to let a man bring his own, because he will inevitably bring the wrong kind. Similarly, he has a tendency to use it until it is worn out. Or, if it

is broken or hard to get into the ground, it may take two moves rather than one to load it. It is easy to see how a man might vary in efficiency 10, 25, or 50 per cent. in shovelling if he brought his own shovel. Suppose he uses his own shovel for a week with 25 per cent. loss in efficiency. At $1.50 per day, we have $9 per week. The loss for efficiency at 25 per cent. is $2.25—rather high rent to pay for a shovel for a week. The tools are certainly an important variable in motion study.

Variables of Motion.—*Necessity of Motion.*—Not one person in ten who reads this can drive a tack properly, or does drive it properly. He could, of course, easily learn how, but we seem to have a natural knack of doing things wrong. We take a tack and give it three blows to start, and then three more to drive it in. One blow to start it and one more to finish it is the practice of professionals, unless they use magnetic hammers and do it all at one blow. The bricklayer, in spreading out mortar, is apt to give three or four little pushes of the trowel, when one would suffice. When he goes to tap down the brick we have all heard him tap three or four times like a woodpecker. One hearty blow would do the same thing and do it better. Show a man a paper bag of cement, and give him a shovel to break it open. He will probably hit the bag in the middle, then have to pull out two pieces or more of paper, when he could have taken the sack, cut the end, and lifted the sack away from the cement in one piece. So on, all the way through the study of motions, we discover the fact that the untrained do it wrong. Scientific study shows many ways in which it could be done with great economy of motion and no increase in fatigue,

but consequent great increase in output. Bricklaying has been going on for thousands of years, and recently it has been very carefully studied, with the result that a man's output more than doubles with no increase of effort, if the material is brought to him in the right way, and he is taught the right motions. Having the brick properly placed the bricklayer simply grasps it, with no inspection or examination, starts it downward, and lets gravity help it to its resting place in a layer of mortar placed with similar economy.

Mr. Gilbreth makes it clear that many of our motions are waste motions, and that we have the possibility of nearly doubling the national wealth by a proper study of the way to do work and the teaching of it to the men who do the work.

Is the Man an Automaton?—There is in many persons' minds a sense of revolt at the idea of being told that if they are going to lay bricks, they must lay them just so, put the brick here, the mortar there, making a certain definite motion that is prescribed in advance. They fear they are going to become machines in doing exactly what they are told. This is true, but there is another truth very much like unto it. No worker is a good worker until he has learned how, and in a measure has taught his hands how, to work. So long as a person is guiding each motion with thought, it is merely slow and awkward practice. No typewriter gets speed until the fingers are taught where to strike without thought. In learning to walk we first think about it, and later our feet do it without thought. Now the difference between standardized motions of motion study and the old-fashioned way is merely this.

In either case the man who has finally learned how has become an automaton. In one case the automaton does the work in an awkward way he taught himself and wastes his motions and wastes his time. In Gilbreth's way he does the automatic motions that have been devised by careful study of the job. Will you be your own awkward automaton, or the scientific and speedy and efficient automaton? No one now objects to learning typewriting in the prescribed and efficient way.

Classification of Trades.—This matter of motion study applied to trades shows there are two types of motion, one requiring strength and speed, the other requiring skill. At the present time the old-fashioned way of performing much work lets the skilled man do a certain amount of unskilled work. Great economies in bricklaying have been produced, in part, by having the hod-carriers place the bricks in the right way and the right position, so that the bricklayer could grasp them and slip them into place. The old-fashioned bricklayer inspected the bricks, took them in hand, flopped them over, and put a certain side down. That is unnecessary. The new bricklayer has them brought to him properly placed. He grasps them and puts them into place. Many parts of skilled work can be done by unskilled workers, such as placing bricks right side up, ready for the bricklayer. So the old trades can be divided into three or four classes, much of the work being done by unskilled workers, who, because of their increased efficiency, should get higher pay, just as the man who does skilled work only can get higher pay, because of the much-enhanced output resulting from the speedier work of the reorganized group.

So great is the work involved in this careful analysis of motion study that Mr. Gilbreth insists that it is one of the legitimate functions of government, just as is the maintenance of agricultural experiment stations; that its findings should be published, so that in time we should have definite methods of learning how to do nearly all trades, just as we now have from private sources definite methods of learning how to run the typewriter.

CHAPTER XVIII

Standardization in Labor Conditions

The Atmosphere of a Place.—We have, in the past two or three decades, followed the usual human experience of swinging the pendulum to an extreme, this time in mechanical and organization devices which ignore the fact that man is, after all, an emotional and spiritual being. Aside from all the details of a purely mechanical nature, there is about a place what may be called an atmosphere, entirely different from the matter of ventilation and the air we breathe. Perhaps it can best be illustrated by the contrast between the ideas of a house and a home. A perfectly-furnished house is not a home at all; it is merely a furnished house. The home element is entirely intangible. It rises out of our attitude toward the place, and that comes out of that intangible thing which the home-maker can put into it. We like this house and furniture, or we do not like it, according to the amount and kind of emotional or spiritual conditions which in a sense animate the surroundings and make the place one which we like to be in, or, in their absence, one which we hate. Similarly there is about every work-place an atmosphere. Is it one which inspires people to successful effort, or is it one which depresses them? About every college and most successful factories there is often what is spoken of as the "spirit of the place." This is often more important that the buildings, especially in the case of factories. A dirty and ugly workroom in disorder breeds

disorder in the same way that pleasing, light, clean, well-arranged conditions inspire to achievement.

It is, I understand, a fact that people sleep better in a burglar-proof room, although we know as a matter of record that bedrooms are not burglarized once in 10,000 or even 50,000 times on the average. Similarly people will work better in a fire-proof place. In general it may be stated that the ideal surroundings for a worker are such that he has to give no attention whatever to them, just as a properly dressed person does not have to think of his clothes. It means that there is no unguarded dangerous machinery, no belts to be dodged, and no whirling shafts liable to wrap the workman's clothes and twist him to death. All those things become cares to him. Energy expended in the form of anxiety and watching does not produce anything. It can be put down as an axiom that anything which takes energy out of a worker reduces his working power.

Distractions.—Noises subject us to a constant series of unproductive efforts. Experimental psychology shows that we can speak to a sleeper and not wake him, yet at the same time we have caused him an effort. His ears hear it, and carry it to the connected parts of the nervous system. His pulse actually quickens in response, although the effort did not happen to be strong enough to wake up his attention. It might be likened to a business correspondence with a firm that did not result in an order. It went through lots of motions, but did not finally get to the cash drawer. Similarly, any one who has slept in a sleeping car knows that the effect is not the same as so much rest in a quiet bed, because his system has been pounded by thousands of jarring sensations, and also by

CHAPTER XVIII

STANDARDIZATION IN LABOR CONDITI

The Atmosphere of a Place.—We have,
two or three decades, followed the usual hı
ence of swinging the pendulum to an extreı
in mechanical and organization devices whic
fact that man is, after all, an emotional ε
being. Aside from all the details of a purel
nature, there is about a place what may
atmosphere, entirely different from the matte
tion and the air we breathe. Perhaps it can
trated by the contrast between the ideas of a
home. A perfectly-furnished house is not a
it is merely a furnished house. The hom
entirely intangible. It rises out of our attituc
place, and that comes out of that intangible
the home-maker can put into it. We like th
furniture, or we do not like it, according to
and kind of emotional or spiritual condition
sense animate the surroundings and make t
which we like to be in, or, in their absence,
hate. Similarly there is about every work-p
phere. Is it one which inspires people to s
or is it one which depresses them? Abo
and most successful factories there
of as the "spirit of
portant that the
tories. A di

an almost continuous succession of noises, resulting in a reduced rest per hour of sleep.

Sights.—Is the worker distracted by things which he has to see? It is a fact easily proved by experiment that our attention is strongly attracted by objects that we see out of the corners of our eyes, more so than by things straight ahead of us. This probably has its origin in long racial experience. Man, for ages, has lived in the open, constantly on the watch. What was that he saw in the grass at the extreme right? Was it a snake, a beast of prey, an enemy in ambush, or a rabbit that he wanted for his dinner? The man hunting game or seeking an enemy has had to be constantly on the watch, and consequently things half seen at the extreme edge of vision have a tendency to compel our attention. Take a worker in the modern factory. Is he compelled to give heed or fight off the temptation to look at a succession of things which he ought not to see? Thus the placing of workers is easily capable of making a large per cent. of variation in their efficiency. And the study of this matter should produce certain rules that placing of workers and work should follow.

An example of this is the condition of the brain worker's desk. What is on it? If he is to give attention to one thing, and there are six there, it is very difficult to look at one without having his attention pass over five or six. Most of us have had the experience of looking at a memorandum of four or five titles, with the intention of adding another. By the time we have got the memorandum out and looked at four or five titles, we have forgotten the thing in mind, because the others had switched our attention. This is a general psychological fact, as I

have proved by tests on numbers of students, and it is a fact that should be availed of by persons who are doing clerical and brain work. It is very much like the question of "decision of choice." Here is the worker who has to receive a large number of objects. Is it a process of merely taking hold of something and putting it into a certain place? If so, it is a simple mechanical thing which becomes as automatic almost as the putting of our foot under us to maintain our balance. But walking down the plain road is very different from walking across a stream where we must pick each step carefully to get upon a stepping-stone. Continuous streams of objects that a worker takes may come to him in such a way that they resemble stepping-stones rather than thoughtless walking. He may have to decide in which hand to take an object, or to look at it to decide what to do with it. In other words, he must make decisions each time, which subjects his brain to a continuous series of thought operations rather than subjecting his hand to a series of semi-automatic or quite automatic operations. An example of this is found in the old- and new-fashioned methods of laying brick. The ordinary bricklayer realizes that he must put a certain side of the brick out to make a wall properly. He grasps a brick laid down by the hod-carrier, and, to decide how to place it, he often flops it in the air, looking at it as it turns, then grasps it at the proper instant and puts it down. Thus he makes decisions and makes several motions in the process of executing the decisions, and, after all, merely finds out where a certain side of the brick was—a needless piece of work for a highly-paid man to do. An unskilled laborer is entirely capable of sorting the bricks, so that in the work of bricklaying the bricks come to the bricklayer ready to grasp.

All he has to do is to take them and put them in the wall. The actual practice, however, in changing from the old style of flopping the bricks to the new style of putting them in the wall shows a very interesting piece of the psychology of work. It is very difficult to stop the flopping and examining habit. Hands and eyes taught to move quicker than thought become automatic, so he keeps on flopping and spinning until with difficulty he has taught himself a new habit.

Standard Equipment and Habit.—One of the strongest reasons for having standard equipment is the fact that it makes habit easier. Suppose a person using a typewriter has gone through the slow and laborious process of thinking where each key is, and how to strike, until it has become automatic. Then a new typewriter with a different keyboard comes along. New habits must be made. Suppose a person must learn to use three machines with three kinds of keyboards. Then it is necessary to have three sets of habits with regard to typewriters, a thing much more difficult than having one set of good habits. The working out of this fact has caused the adoption by most of the typewriters of a standard keyboard, so that a person can move to one or the other without teaching the fingers any important new thing. This has been brought about by the necessity of typewriter companies for putting in a machine which could be utilized because its keyboard was like the others. It is one thing to convince the owner of a machine that the make is good, but quite a different thing to convince him and his operator that it will pay to learn new habits to run the new machine. This example is typical of an indefinite number of situations which arise in modern production. It also shows the diffi-

culty of comparing the new with the old. Theoretically, of course, comparisons are easy. Tests, however, require experiment under similar conditions. Here is the old typewriter which the operator knows how to use. When can we truly say the new one has been fairly tested? Plainly not fairly until the new one has been subjected to a similar degree of habit, which in the case of the operator must consist in the unlearning of one habit and the learning of a new habit, or taking a fresh beginner and bringing her up on the different machines until she has had similar opportunities of testing. And, of course, comparisons of one person with another are unfair, because it is a fact that we vary tremendously in the speed of our perceptions and motions, and two persons of equal intelligence may have variations of 50 to 100 per cent. in speed with which they can operate a typewriter. Yet in some other phases of activity, the slow may be superior to the speedy.

Standard Clothes.—Not long ago many workers were allowed to bring many of their tools, such, for example, as shovels, but the discussion in a previous chapter has shown how each kind of shovelling requires a different shovel, and if a man brings his own he may easily be working at 5, 10, 15, or even 50 per cent. inefficiency, which makes the rent an employer pays for the freely-contributed shovel exceedingly extravagant—perhaps $3 a week. Similarly the point has been made very emphatically by L. M. Gilbreth and others that the lack of standardized clothing for work is often a considerable handicap, because we need to have certain freedom of motion which certain clothing gives and certain other clothing prohibits. Often we need to have it made for the purpose of holding various equipment, such as the car-

penter's rule, nails, etc. The prediction is made that in a short time we will have standardized working clothes, even if the employers have to buy them for the worker, just as they now buy shovels rather than let the men bring their own, and for the same reason that gain in output will exceed cost. Also there is a psychological factor; namely, clothing is the sign of the craft and carries with it the respect which belongs to the good craftsman. At the present time perhaps the most thoroughly standardized clothes are those of the athlete for athletic performances, which have been arranged to afford the least possible interference.

Standardization and Accident.—In a works where conditions have been thoroughly standardized opportunities for accidents are, of course, greatly removed, because an accident is such a great variation from the standard motion that there has been some serious collision.

Standard Output.—Thousands of persons are often for months at a time in constant anxiety as to whether or not they are going to be laid off. They do not know whether or not their work suits the management. This could scarcely be in a plant where thoroughly standardized conditions of production have been established, for the reason that there would inevitably become a standard quality and a standard of what was satisfactory, so that the worker would know whether he was or was not up to the efficiency mark. If he was, the point first mentioned, namely, peace of mind, which is a factor in efficiency, would make any decent management let him be sure, so long as the work was up to standard, that he was secure so far as the works could make him so. Therefore his anxiety need not concern itself for things within the works, and could only

arise from the fear that a general depression or lack of prosperity might make it necessary to reduce the output.

Standardization and Animal Work.—Everything that has been said about the necessity of standard motions with regard to human workers has much more emphatic reason for being said in connection with our four-footed brethren. It is a waste for a man to have to make decisions and evolve his own way of doing things. It is much worse for the far less intelligent horse to have to try to adjust himself to uncertainties and different ways of doing things. Gilbreth has emphasized the great necessity for standardization to promote horse efficiency. Man should go to the animal in a definite and constantly-followed way. Thus the man approaches the horse or cow on a certain side and does certain things in a certain order. As an example of the way animals habituate themselves to this is a fact that the ordinary, quiet, peaceful cow, who has been taught, as is the habit of American cows, to be milked on her right side, will quietly chew her cud and cheerfully give up her milk to the milker day after day, for months, but if he approaches her on the other side she will kick him. There is nothing in the world involved except her habit. We have all seen, perhaps, the milkman's delivery horse. He knows his streets, what turns to make, knows his houses, starts, stops, and, as the driver approaches the wagon, starts just as the man lands on the shaft or the steps of the wagon in motion. It would take a lot of bother if every one of those motions had to be attended to by the man, but so long as the round is definite the horse will soon learn it, and he becomes an automaton, permitting all his effort to go to productive work and doing a surprising amount of the driving himself; but if he is treated in

various ways he cannot do this, and he is harassed and distressed besides, and horse distress costs just as human distress costs. The average user of animals greatly overestimates their intelligence. The great value of the horse and mule and ox is not their intelligence, but their stupidity. They are dull enough to be our slaves, and merely have sufficient intelligence to be taught a small round of habits of great value to us. If they were as intelligent as the crafty and rebellious cat, we would get nothing out of them except the privilege of looking at them.

Standard Records.—After all the various kinds of standardization have been working out in a plant, there comes the question of records. Something has been attained. We wish to keep it. How shall the record be made? It could probably be done by a page of writing, but this method is bad, because of the great difficulty of writing clearly, not to mention the fact that it takes a long while to make the page of writing. If there is any better way than the written page, it should be followed, because of the inaccuracy that a written page involves. It is very difficult not to make a cross-eyed sentence, namely, one capable of looking two ways, and your written page would probably not be clear to one of ten men who read it next week, and might be uncertain to the author a year hence. Consequently, aside from all questions of time, there is a great advantage in some kind of standardized page. A set of books, indeed, is a standard record page. We have agreed, after much study, that it is best to have certain columns with certain names to which certain classes of facts go, so that in the end we are able to have a snap-shot or cross-section of a certain phase of the enterprise; namely, the financial aspect. But in records of

work we have many more things which we need to introduce to get a similar view. Therefore we fill in blanks, perhaps with a list of words and symbols to be checked. Thus a big, complicated page permits a man to put in a few numbers, apply a rubber stamp, a few checks, and he has put down the equivalent of a paragraph of writing, and it is better than writing, because it permits of interpretation in only one way. The blank forms of the modern scientifically-operated factory become matters of very great importance. While that may look tiresome to those of us who do not happen to be interested in such methods, it is of the keenest interest to the man who works with the problems involved. A new device in bookkeeping will easily let a man see twice as much about the condition of his plant. So, since the new ruling of paper, the new method of recording facts about the conditions of work or the cost of work gives a factory manager a new insight into the cost and other problems of production, the improvement of a printed blank form is often a discovery equal in importance to the improvement of a machine, and the improvements in records of the scientifically-managed factory have had bestowed upon their creation hundreds and thousands of hours of high-class brain work. The change in a form becomes an event, an achievement often of large financial significance.

Standard Time.—After standardization of motion and standardization of conditions of production have been worked out, we are ready for the final thing in standardization; namely, standard time. How long does it take to do things? How long does it take to drive a nail, saw off a board, shovel up a shovelful of dirt, run a wheelbarrow a yard, and so on? The civil and mechanical engi-

neers have at their disposal a hand-book which contains thousands of facts for ready reference, definite actual facts which give them the units of engineering performances. How much water will run through a pipe? Turn to the book. Is it an inch pipe, or two inches? It makes no difference, there is a table which will tell you that an inch pipe of a certain length, with certain pressure per square inch, will have water going through it a certain number of feet per second, and will discharge a certain number of gallons per minute. What will a 2 x 4 yellow pine plank support? If one foot long, so much; if two feet, so much less. What is the breaking strength of a No. 9 wire of certain quality? It is there. What force does it take to crush or break by twisting or pulling apart concrete? The books have there the records of thousands of experiments which tell this fact, and the element of safety that should be allowed in making the unit, so that a graduate of a technical school can take this book and secure from it the materials for designing an ordinary bridge, and then figure up the dimensions and cost of same for building. But how long will it take a lot of men to dig a sewer? Where are the units? Until recently they did not exist, but Mr. Frederick W. Taylor made the prediction that the time is coming when we will have a manager's hand-book just as we have the engineer's, and that the important thing upon which it starts will be the unit times. The point is well made that the unit needs to be small. Take, for example, the case of loading up a wheelbarrow load of sand, wheeling it fifty feet, and dumping it. A man with a stop-watch times this operation for many men working under fair conditions until he has an average for the length of time it takes for the worker to get the shovel

into the sand pile and filled, the time it takes to lift the shovel up to the wheelbarrow of proper height, the time to dump the shovelful of sand, the time to move the shovel back to the starting-point. Those are the correct units of shovelling sand into a wheelbarrow. When loaded, how long does it take to drop the shovel, get the wheelbarrow up, and to start? After starting, how long does it take him to move a foot or a yard with a loaded wheelbarrow on the level? How long to come back with an empty wheelbarrow, per foot or per yard? Finally, when these units are satisfactorily worked out, they are units like unto the mechanical or civil engineer's hand-book units. The second job which permits the manager to utilize results of this time study would be shovelling up and filling a wheel-barrow with *clay*. Much of the work is the same, but there is one element of difference; namely, getting a shovel into a pile of clay and getting it filled with a different kind of material. It will require a push or perhaps two pushes into the clay. Therefore that element alone differs, unless it is sticky and needs to be banged in getting it off. Certainly lifting up of the shovel, the rate of emptying, and the wheeling are alike. Therefore the standard of sand shovelling can be utilized in part for the standard of clay shovelling, and we have a demonstration of what is meant by the manager's hand-book.

CHAPTER XIX

The Wage Question

Wages have vexed mankind ever since he stopped keeping slaves, and the freer man becomes the greater is the wage vexation.

One of the things in which it is, so far as we know, impossible to lay down a set of standards upon which we can agree is the question of wages. I have had a lot of fun proposing the following question to classes of undergraduate college students, and to classes of extension school students where the men were in business and were from twenty to fifty years of age. Here is the question:

Suppose fifty of us city dwellers should happen to be in the woods of Maine. We know nothing about woodcraft, but our local hunter guide knows the habits of the moose, knows where there is one, but can't get it by himself. However, if fifty of us get together and help him, the matter is simple. The following device is usually employed in catching elephants and some other kinds of big game. The men spread out fanlike and beat the bushes of a large expanse, gradually converging to a point where a stockade is built, and drive the game into the trap. Fifty of us could not do it without the expert guide, nor could he do it without us. How shall we divide the proceeds? Almost invariably the class gives the numbers as follows: expert from one-sixteenth to nine-tenths. I have had one case where a man said we should all divide equally and let the guide get the same as the rest. But the fact that the average American gives such a widely varying share shows that we have no uniform conception to apply to the situation. Certain types of socialists say we should all share alike in the results of

labor. Others insist with great vehemence that men should be paid what they earn, but I dare anybody to show what many men in the modern complexity of industry do earn. It is easy to show what they *get*. But what do I as a college professor earn? What does the locomotive engineer at the throttle earn; that is to say, what does he produce? There is absolutely no way of telling. We can go into enterprises and can agree upon various methods of dividing up the proceeds, but after we have made that agreement we still have opportunity for a long discussion as to the fairness of the basis of division. There has, to my knowledge, been one very interesting attempt to lay down a basis for the division of proceeds. The Karl Zeiss Association of Jena, Germany, was founded by Karl Zeiss and Professor Abbe. Abbe was a professor of physics, Zeiss an optician. Between them they devised a better method of making glass and a better method of grinding it. Their company is making Zeiss lenses, which are in most good microscopes and field-glasses—in every theatre and every steamship the world over. These two idealists concluded they did not want to make for themselves big fortunes for the probable damnation of the next generation of their families. They preferred to benefit the community, so entered into an arrangement whereby the highest paid man in the enterprise should receive ten times the wage of the lowest paid. Thus, if the ash wheeler got four marks, or $1, Zeiss and Abbe got $10 a day. In between were the various degrees of skilled labor rewarded at some place between these two figures. The rest of the money went to the town in the form of parks, bridges, hospitals, libraries, schools, making it a very admirable place to live. Now why should they have taken ten as the highest? Why not eight, why not twelve, or

twenty? It is the basis for a good hot discussion, with small possibility of agreement.

The Other Opportunity.—As a matter of fact, we do not give men what they earn. We do not treat them all alike. We give them, in the main, what they can get elsewhere. Suppose five hundred educated men from an American college should be dumped down on a splendid island in the middle of the Atlantic Ocean off New Jersey, where the warm Gulf Stream would give a climate with little frost but very open winter. Suppose this island to have lots of timber, good coal, waterfalls, iron ore, limestone, and half a million acres of gently-rolling fertile plain covered with good grass. Suppose each of these men has $5000 on deposit in New York, but is compelled to live on this island the rest of his days. He is free to bring his immediate family, but the whole group can bring over only outside workers of any sort to the extent of one imported man to ten of those present on the island. Further conditions of the plan are that the group gets together, forms a government, and decides each person shall be free to take up 100 acres of coal, 200 acres of timber land, 700 acres of grass land. Some of the grass land is underlaid by light soil suitable for truck farming. There is a bay with lots of oysters and fish, a fishing bank off shore similar to Newfoundland. They can have entire freedom of importation and exportation to the United States, of which our island is a part politically. Now, then, what will be your business and what will be the rate of wages in case you need to hire somebody? Of course, every man has his thousand acres of land, and if you propose that he work for you, you must tempt him by wages better than he can earn upon his own premises. As sheep and cattle raising are industries which require almost no labor but herding and

watching of animals, this island would at once become a great sheep ranch, just as has every similar piece of land man has got hold of, Arizona, Wyoming, Montana, Australia, New Zealand, Argentina, and the rate of wages would be high because of the opportunity for man to work for himself.

Proof of this wage condition has been furnished over and over again by the conditions prevailing in new countries. Perhaps the best of all is the example of Cape Nome, where a gold rush found but little gold, and wages at once dropped to merely enough to keep men alive. Then all of a sudden dissatisfied seekers discovered gold for miles on the beach, and everybody could take a pan and make $10 a day, which promptly became the wages in the restaurants and hotels where they had been previously at the subsistence point. In San Francisco in 1849 one hundred ships lay idle in the harbor because the crews had jumped overboard, and swum ashore to get $15 a day rather than stay by their contracts and take the ships back to New York.

This matter of abundant resources is really the only point of difference between the United States and Europe. We have the people, the language, the laws, ways, churches, and society of Europe, but the abundance of land has given opportunity which has been interpreted into higher wages. The conservation movement aims to maintain this opportunity and is therefore perhaps the highest patriotism.

Suppose this same group of college students should be put upon a second island identical with the first island mentioned, a few miles from it, but containing only 10,000 acres. What would be your job and what would be the rate of wages? Both would differ and the wages would be much less, probably set by the income of fishermen working on the off-shore banks.

CHAPTER XX

The Payment of Wages

Here is the work, and here is the worker who does it. How shall he be paid? The problem is as old as history, and as far from solution as many of our other problems. It is plain that there should be some ratio between work and reward, yet, owing to the variable character of much work, it is impossible to pay for it on this output basis. Therefore the alternative method of mere time payment comes in. One of the accompaniments of the recent movement toward the increase of industrial efficiency has been much effort to increase the proportion of work that is to be paid for in proportion to output, and then carry it a step further and make greater difference in the pay of individuals because of differing abilities.

There are four chief methods of payment of wages; namely, day work, piece-work, task work and bonus, and differential rate. The first and second of these wage systems include the great bulk of industrial effort at the present time. The third and fourth are for the most part recent introductions, and in the total they amount to but a small proportion. It is probably true that the proportion of day work is sharing the same fate as unskilled labor; namely, decreasing in favor of the second class, piece-work, just as the unskilled labor is decreasing in favor of second-class labor; namely, the machine tender of intermediate type of skill. The third class, task work and bonus, is much less common than piece-work, while the differential rate is even more rare. These two latter have been brought to the fore

in the recent experiments with scientific management. One of the leading exponents of scientific management, Mr. Gantt, asserts that the object of scientific management is a task for every one.

There is little doubt that day work is a very unsatisfactory method, both from theory and practice, for the reason that it can give little or no recognition to the fact that men are of different values. The attempt to reward A is apt to make B dissatisfied. Because of the lack of definite measurement of output, B thinks he is as good as A, or at least claims that he thinks so, which amounts to almost the same thing from the standpoint of diplomacy and relationship within the works. As an evidence of the weakness of the system of day work, experiments have shown double output with no increase of wages, merely because it became known just what every man was doing. By this mere turning on of the light or of having knowledge (like the force of public sentiment) we produce this 100 per cent. increase. This bears a striking resemblance to publicity, which has in places been so effective in connection with public service or quasi-public corporations.

Where men are paid by output, but work in gangs and the output per man is not measured, the situation is almost identical to that prevailing where ordinary day wages are paid. The loafer quickly discovers that he is not being paid in proportion to what he does. If he loafs, he gets his proportional share of the whole. If the honest man works hard and does twice as much as the loafer, he still gets but an equal share of the whole. Therefore every man takes it easy to keep from working unrequited. As a good example of this condition and its influence, Taylor, in his experiments at the Bethlehem works, paid each man for his own

work at unloading pig iron. But some men left and went to Pittsburgh because they heard the ton rate there for unloading was greater. In a month they were back at Bethlehem, because they could make less at Pittsburgh with a higher rate than they could at Bethlehem with a lower rate, At Pittsburgh eight or ten men worked on a car, and they were not paid individually for what they did. Thus they all assumed the ordinary loafing gait which day work may normally be expected to produce.

Piece-work and Rate Cutting.—The fact that in day wages the individual cannot be rewarded for particular efficiency tends to drive the best to the standard of the lowest, and compels organization as the means of getting wages up. In contrast to this, the scientific management people have laid much emphasis on the importance of relation between output and wage. Piece-work is exactly that and it should not be forgotten. The chief thing that is the matter with piece-work is the fact that employers will cut the rate.

In the discussion of labor we must recognize the fact that it is primarily a problem in human nature. In so far as we know, history gives us little reason to anticipate any changes in human nature in any time of which we may need to take heed. It seems that one of the things with which industry must deal is the propensity of employers to cut piece rates at the slightest provocation and often to their own detriment. There are several reasons for this. One is the inherent desire to get things as cheaply as possible, which is ever popping up in ways which make man appear almost as a slave driver—when he gets the chance. The second reason is a certain deep-seated notion

of what is proper for a certain kind of man to get or for a worker at a certain kind of work to get.

It simply violates all proprieties of the employing mind for a man who has been getting $2.25 to suddenly get $4 or $5. He must be cut down, so the rate is cut. This amounts to a premium upon loafing and deception, so the man hides his powers of production and the plant runs along with only a partial output. An astonishing and almost ludicrous case of this has come to my personal knowledge from a plant making a very well-known patented machine. There was a room in which a number of metal finishers took a certain piece of metal and ground it for a finished process, making $2.25 to $3 a day on piece-work. One Monday morning a Russian entered the room and by dexterous motions began to whirl off finished pieces at a most astonishing rate. By ten o'clock the men were begging him to slow up, by noon they were working on him in twos and threes. But he did not hear. By Monday night he had earned $8. All day Tuesday the process of persuading him continued, with no results. And what do you suppose happened to him? On Wednesday night he was called into the office, paid $25 for three days' work, and discharged. The spectacle of a man making $8 a day was one that the company could not stand, although it was a manifest reduction of the cost per piece to the company. What better object lesson, what better incentive to "soldiering" could workmen have than that?

A Premium on Loafing.—This episode is typical in its main aspect of tens of thousands that have occurred in the shops of America and other countries. It amounts to one of the most effective possible premiums on loafing, and *it is done by employers*. By its effect thousands, perhaps millions,

of workmen know that if they speed up and increase their output 50 to 100 per cent., as they often can, they will not be allowed a 50 or 100 per cent. increase in wages, although it is one of the most easily demonstrable things to show that this increasing of output by the machines is a reduction in the cost of manufacture. The great stumbling-block here is the notion that a man in a certain kind of work should not get more than a certain amount of money.

Workmen are not fools, cut the rate on them once and you have made them "soldierers" for life. The clearness with which this is recognized and acted upon even by apprentices who are working in factories in connection with their school work really causes one who looks at it from the outside to wonder why rational persons can have let themselves bring such a situation to pass.

This reward on loafing has produced the situation which Mr. Taylor calls "systematic soldiering," in which the man is very carefully nursing his job, deceiving the management, keeping his output down because he knows that if he speeds up he will be penalized by being compelled to keep the rate up and take his old, or approximately his old, wage.

Proper Rate Cutting.—The condemnation of piece-rate cutting does not necessarily imply that piece rates can never be changed under good management, but in an industrial situation like that of the present, in which we have a general rising standard of prices, the piece rate cannot be lowered unless the management has made improvements of some sort in machinery or method which permit the worker to get an increase of total daily wage at the same time that the management gets an increase of total daily output. In other words, they practically divide between them this new thing they get, namely, increased

output, which, while it may all be due to the new machine and to no increased effort on the part of the worker, is, nevertheless, a joint product, psychologically speaking, and must be so treated. In this respect Mr. Taylor, when engaged in work in the Midvale Steel Works in the process of the evolution of his new methods of management, reduced the rate on certain pieces of lathe work from 50 to 35 cents. At the same time he had made improvements in the lathes and methods of running them whereby a man could increase his daily output from five to ten pieces and his wages from $2.50 to $5.50.

Time Study and "Soldiering."—"Soldiering" is possible chiefly because the average American manufacturer does not know how much work a man can do or how much a machine can do. It is partly due to skilful deception by the worker, and partly due to the fact that our industrial system is so new that we have not yet got acquainted with its elements.

A man cannot "soldier" like this if the management really knows how much a man and a machine could and should do. This requires time study of work so that we can have standards. When it comes to simple matters like walking down the road, a man cannot fool another man much. We know three miles an hour is a good gait, four miles is fast, five miles is virtually impossible, two and one-half loafing slow. Therefore somewhere between three and four miles per hour is to be expected, depending upon local conditions. That has been the result of a time study.

Now, by time study, Mr. Taylor would gain that same definite knowledge of what fair human effort should produce all the way through the works, so that the management may know when people are loafing at work just as surely

as they would know when they are loafing at walking. This makes possible a different type of wage payment which is really a modification of the piece-work system. It is task work, in which a person is to do in a certain time a certain amount of work. As an inducement to men to do these tasks, a bonus is given, so that we have a wage payment called "task work and bonus."

Task Work and Bonus.—The idea of a definite task bears a strong relation to one of the great facts of human nature. We seem to like to have a definite object for our activities. Thus the average person dislikes a gymnasium for merely taking exercise for exercise's sake, while nearly everybody likes games which make effort for the achievement of some definite though economically useless task. Thus men who abominate a mere walk love to play golf, because with every shot, with the attainment of every hole, with the attainment of a complete round they have always a task, and they do it with as few shots as possible, or less than some previous record or some definite self-assigned standard. Schools the world over have discovered that study is best promoted by short, definite tasks. Factory work is like school work in this respect. It is a fact that in industry the shorter the task the easier it is to attain it; not a week, or a day, or a half-day, or a whole job, but the parts of the various jobs, so that as weak human nature tends to fall behind, the man is always prodded by the task idea for the attainment of some definite unit in the assigned time. Thus, while he might fall down on an hour's job, if it has five parts, each of which has to be done in twelve minutes, he can keep himself up to the standard, for this ability to keep up to a task, and a long task, is one of the important measures of civilization.. Civilized man can wait,

endure and get a surplus. The less civilized man, as the tropic denizen, cannot do this, and so, instead of getting a surplus and capital and advancing, he spends what he gets and maintains his level. This endurance of the northern man, rather than the tropic, is not a measure of inherent virtue. It is a measure of the fact that the cold northern environment has made it necessary for the man of the north to be able to endure and wait, whereas the man of the south has been able always to find Nature's supply of food at hand.

How shall this task idea be utilized?

The Towne-Halsey System of Payment.—One attempt to utilize the task idea and at the same time get away from the ridiculous loafing that results from systematic "soldiering," is the interesting compromise system of wage payment known as the Towne-Halsey system. In it there is, first, an agreed-upon rate of pay for a given piece of work, which, of course, involves decision as to the proper amount of time it should take. Secondly, there is a division between the employer and the worker of the advantage which results in the worker getting the work done in less than the allowed time.

The Towne-Halsey plan consists in recording the quickest time in which a job has been done, and fixing this as a standard. If the workman succeeds in doing the job in a shorter time, he is still paid his same wages per hour for the time he works on the job, and, in addition, is given a premium for having worked faster, consisting of from one-quarter to [illegible] difference between the wages earned and the [illegible] y paid when the job was done [illegible] [illegible] lsey recommends the payment of [illegible] ice as the best premium for [illegible]

cases. The difference between this system and ordinary piece work is that the workman on piece work gets the whole of the difference between the actual time of a job and the standard time, while, under the Towne-Halsey plan, he gets only a fraction of this difference.

It is not unusual to hear the Towne-Halsey plan referred to as practically the same as piece work. This is far from the truth, for, while the difference between the two does not appear to a casual observer to be great, and the general principles of the two seem to be the same, still, we all know that success or failure in many cases hinges upon small differences.

After this system has been in operation for a year or two, if no cuts in prices have been made, the tendency of the men to "soldier" on that portion of the work which is being done under the system is diminished, although it does not entirely cease. On the other hand, the tendency of the men to "soldier" on new work which is started, and on such portions as are still done on day work, is even greater under the Towne-Halsey plan than under piece work.

To illustrate: Workmen, like the rest of mankind, are more strongly influenced by object lessons than by theories. The effect on men of such an object lesson as the following will be apparent. Suppose that two men are at work by the day and receive the same pay, say twenty cents per hour: Smart and Honest. Each of these men is given a new piece of work, which could be done in one hour. Smart does his job in four hours (and it is by no means unusual for men to "soldier" to this extent). Honest does his in one and one-half hours.

Now, when these two jobs start on this basis under the Towne-Halsey plan and are ultimately done in one hour

each, Smart receives for his job 20 cents per hour + a premium of 60/3 = 20 cents = *a total of 40 cents.* Honest receives for his job 20 cents per hour + a premium of 10/3 = $3\frac{1}{3}$ cents = *a total of $23\frac{1}{3}$ cents.*

Most of the men in the shop will follow the example of Smart, rather than that of Honest, and will "soldier" to the extent of three or four hundred per cent., if allowed to do so. (F. W. Taylor, "Shop Management.")

The Towne-Halsey system shares with ordinary piece work, then, the greatest evil of the latter, namely, that its very foundation rests upon deceit, and under both of these systems there is necessarily, as we have seen, a great lack of justice and equality in the starting-point of different jobs.

The chief advantage claimed for the Towne-Halsey system is that it greatly reduces the temptation of the management to cut the rate. The gross injustice and inaccuracy of its beginning are, of course, largely obviated by careful and accurate time study, which was one of Mr. Taylor's great contributions. By time study he removed most of the uncertainty, and was enabled to get a much more definite task and give a clean-cut basis for a system of wage payment called "task work and bonus."

The Difficulty of Task Setting.—Here is a plant working on task work and bonus. The management says to the workers: "Here are these machines and this material. You must do so much for a fair day's work. On its completion you will receive your day's wage, plus something—a bonus." At once this gives to the management a great responsibility: namely, the fair decision of what is a task. This cannot perhaps be better illustrated than by the details of task setting by Mr. Taylor, Mr. Gantt and others, when they applied it to shovelling of raw materials in the Bethlehem yards.

They had men shovelling pea coal, rice coal, bituminous coal, coke, sand, loam and iron ore of several varieties. Now, then, what is a fair day's shovelling for a man? They found the kind of shovel the men brought into the works would hold 3¼ pounds of rice coal as a man unloaded one car, or 39 pounds of Mesaba iron ore in the next car. Plainly, both of these figures could not be at the point of maximum efficiency. Did any contractor know what was the proper amount for a shovelful? He did not. Did any foreman know? He did not. Consequently Mr. Taylor took two good men, gave them double pay to obey orders and do a good day's work. Then he put them at shovelling iron ore and cut off the point of the shovel, so that it held 38 pounds. He let the men work all day, keeping exact record of the amount moved and the number of shovelfuls handled. The next day the shovel was cut to hold 34 pounds, with an increase in output; the next day, to 30 pounds, with still an increase; the next day, 26 pounds, with still an increase. At 22 there was still an increase, and at 20 it showed a decrease. At 18 there was a still further decrease. Careful testing showed that 21½ was the amount of shovel weight for the average strong man to reach the maximum of shovelling. The question was, what kind of shovel would hold 21½ pounds of each of the various kinds of materials? This study of the art of shovelling loose materials in this particular steel works required the service of educated experts for a year, and resulted in the building of a shovel house, where they kept ten different kinds of shovels for ten kinds of work. This experiment admirably shows that the man who can do the work, almost necessarily does not know the best way to do the work. If task setting with a shovel is so difficult, how about the machine which has about

a dozen variables, including the question of the angle of the cutting part, the angle of its edge, the depth of the cut, the speed of the cut, etc.? How many combinations are possible in nine variables? The number is 1 x 2 x 3 x 4 x 5 x 6 x 7 x 8 x 9. Upon working this out you will get the number of possible combinations—416,880. Thus, a machine is actually capable of being set many thousand ways. Does the workman know the best one? Manifestly, he cannot know it, although he might stumble on it once every few years. Experiment, however, can develop definite instructions for each particular kind of machine in the machine shop.

Determination of a best feed and speed for cutting metals looks simple, but Mr. Taylor and others made 50,000 recorded experiments and many more unrecorded to get scientific knowledge on this point. They spent a fortune doing it. These examples perhaps serve to illustrate the fact that the setting of definite tasks at the best rate of efficiency for man and machine is not as simple as it may look. Apparently running a loom looks as though it might be an exception, yet Mr. Gantt gives record of a plant that thought it was ready to establish tasks. They put one weaver at it. The first day there was a failure. The next eleven days were spent by the management in tinkering, studying, getting the bobbins filled properly, and everything about the machine arranged so that it would be uniform and standardized, so that they could in fairness tell a worker this was his task, a fair task, and he could do it. Then he did it, and the weaving-room went over gradually to task work and bonus.

Mutuality of Interest.—Once the task idea is put upon the workman, he has a come-back in case of failure to make the task. "Why," he says, "it is the management's fault.

Something isn't right." It must be shown, of course, that everything is right. The study of method and prescription of method means that there are definite instructions around, so that a practical part of the task idea becomes the creation of the instruction card. There also tends to be a very new point of view between the instructor-foreman and his workers and the old type of foreman who had no direct interest in output. The task-work foreman, if properly connected with his job, has as his task the fact that the workers under him make their bonuses. Here are the ten men working. At three o'clock it becomes evident that one of them is in danger of missing his bonus. The foreman is also going to miss his 5 cents a day for this tenth worker, and, further, is going to miss 50 cents a day extra that he gets when all of his men make their bonuses. Therefore, he has 55 cents at stake. By the old-fashioned way he had nothing at stake. Manifestly, therefore, he might abuse, try to drive and coerce worker No. 10, if he bothered him at all. Now, however, he has 55 cents interest in worker No. 10's efficiency, and worker No. 10 has his bonus. They are partners. Instead of the abusive driver, we tend to get the helpful teacher.

Investigation of Failures.—One of the important parts of the task system is the prompt investigation of every failure to win bonuses. This keeps the management constantly in touch with conditions and on its mettle to keep things up to working order. This tends strongly to throw the idea of task into the management as well as into the workers. All are alike bound up together, and there are few things that can get the works into unity more thoroughly than this. This fact tends also to explain the cause of a great objection to the task system. The idea that the chief objection lies

with the workers is often not correct. It is more often raised by foremen and the "higher-ups." This is especially the case where a lot of "higher-ups" have got their jobs through "pull" and inheritance, rather than merit. Once the task system is well applied in a plant, it is impossible to keep it out of even the top ranks, and everybody has his task. A definite test may be an awfully unpleasant thing for the young man of forty, who got his job because he happened to be somebody's son.

The Expert and the Task.—The difference between expert work and standardized work is the fact that one can, the other cannot be reduced to written instructions. If work is capable of being reduced to a definite instruction, it is no longer expert work. It is skilled work. Expert work, however, is so vague or indefinite or refined in its execution that it defies accurate description. Such, for example, is the work of the surgeon, the great operator. He can have the patient on a table, surround himself with other surgeons, and show just how it is done, not only tell, but also show, and still there is so much difference between success and failure, so accurate must be the stroke, so light the hand, and so quick the eye, that the master operator is left in a class by himself.

To go back to the industrial works—it is true that a large proportion of the work called expert is capable of being reduced to standards by the application of careful study and description, and the expert constantly sees himself menaced by the danger of seeing his skill reduced to an instruction card and himself perhaps replaced. Here is one of the big causes of objection to task work, with its implications of careful and thorough standards.

Condition of Machines.—The fact that the worker has a direct interest in the output and amount of output means that, instead of the machine being the responsibility of the management, it becomes the responsibilty of the worker, and tends therefore to be much better cared for.

Go Slow in Making the Change to Task Work.—One of the great difficulties in the installing of such reorganization into industrial works is the great desire of everybody to make it go too fast. It has been quite generally found impossible to keep superintendents from pushing it faster than it could go, until failures taught them. The reasons for going slow are several.

First, the difficulty of actually attaining standard conditions.

Second, the difficulty of setting a task that is a fair task.

Third, the psychological resistance to change. We are creatures of habit. With one hundred workers in a plant, the mere knowledge that there is going to be a change tends to produce a feeling of resistance. If there is an attempt made to put a large proportion of these people upon new methods at once, this resistance can rarely be overcome. Sometimes it takes days or weeks to get even one person started. Then gradually another and another will come in, perhaps only after difficult persuasion. Then a little later on, when a considerable proportion of workers are on the new system and getting more pay, it becomes the style or the fashion of the works. "The fashion" of the works is a very important factor. It shows the interesting results that in the beginning of the task system in a textile mill, it took a girl a long while to learn the new method. In the end, after it had become the style, it took them a far shorter time to learn—another illustration of the point which we are ever

tending to forget in this super-mechanical epoch, that, after all, folks are human beings, and that, despite all our new machines, systems, devices and equipment, there is a very large element of psychology, or human nature, and that it will always be with us.

Differential Rate.—In his application of the task idea through the differential rate, Mr. Taylor may be said to have applied a push and pull to the workmen. Task work and a bonus may properly be called a pull. The bonus is a pull to the workman to make more than a given task. The differential rate part of it, however, gets in the pull very effectively by giving the man a high rate in case of success in making the task, and a pull in the form of a low rate in case of failure. For example, if the task is ten pieces per day at 30 cents each, the workman who gets eleven will receive 30 cents each for the first ten and some agreed-upon bonus for the eleventh. But the man who gets nine will receive a rate of 27 cents each for each piece that he makes. Here, manifestly, is a strong stimulus to make him keep up to the standard.

Only Two Kinds of Pay.—Some careful analysis of the Towne-Halsey system, the task and bonus system, the differential-rate system and all the rest of the bonus systems will show that, after all, they are but modifications of the piece rate, in which the management does not give the worker the full rate for all of his output. Perhaps they are but transitional methods, and as our industry becomes older and more established and static, we will have an increasing tendency toward the plain piece rate, which really gives the worker 100 per cent. bonus. However, the insistence upon a certain standard or task per day is entirely fair, particularly when overhead charges are counted. Heat,

light, floor space, power, interest, depreciation and many incidental elements that combine to keep the machine before the worker and make what we call overhead charge—these are reduced by full production and increased by slow production, and on that basis alone there are adequate grounds for the use of the task idea in the most thoroughly-established industry, such as the English cotton spinning industry (which will be discussed more fully later). In this way a differential rate might be used to penalize plain inefficiency in a worker, or, better yet, to prevent a tendency toward inefficiency from coming to the surface.

CHAPTER XXI

The Control of the Working Force

Here there are a thousand men engaged in the many plicated tasks which result in the production of a reaper, or an automobile, or a whole line of machinery, or any other factory product or products. How is authority divided among these men that they may be adequately managed for the purpose in hand?

There are two general types of management, sometimes spoken of as line and staff, both of which can be seen in an army. So far as fighting is concerned, the general gives orders to the colonel, the colonel to the major, the major to the captain, the captain to the corporal, and the corporal to the individual men under his command. This authority is delegated in a direct line. Each man is responsible to the man above him and to him only. At the same time there is in this army another type of organization, commonly called the staff. With regard to the fighting, the private is subject to the corporal, but with regard to his food, he is responsible to the commissary department. It feeds him. When he is sick, he is responsible to the medical department. It attends to his health. When he crosses a river, it is on pontoon bridges that have been built by the engineering corps. There are several departments in this army, each having more or less authority over the private soldier. Within each department—the engineering corps, or the commissary, or the medical division—there is again a complete organization of authority on the line type.

The Military Factory.—Factory organizers of the old

school have been much in the habit of having their authority run on the strictly military or line plan, with the grouping of many kinds of authority in one man. It looks very simple to see a foreman with ten men under him who are responsible to him for everything. It is simple in its external form, but when we analyze the task that this foreman must live up to we see that the simplicity is only in the appearance. In fact, his *job* is very complicated. Witness its description by Mr. Frederick W. Taylor:

First.—He must be a good machinist—and this alone calls for years of special training, and limits the choice to a comparatively small class of men.

Second.—He must be able to read drawings readily, and have sufficient imagination to see the work in its finished state clearly before him. This calls for at least a certain amount of brains and education.

Third.—He must plan ahead and see that the right jigs, clamps and appliances, as well as proper cutting tools, are on hand, and are used to set the work correctly in the machine and cut the metal at the right speed and feed. This calls for the ability to concentrate the mind upon a multitude of small details, and take pains with little, uninteresting things.

Fourth.—He must see that each man keeps his machine clean and in good order. This calls for the example of a man who is naturally neat and orderly himself.

Fifth.—He must see that each man turns out work of the proper quality. This calls for the conservative judgment and the honesty, which are the qualities of a good inspector.

Sixth.—He must see that the men under him work steadily and fast. To accomplish this he should himself be a hustler, a man of energy, ready to pitch in and infuse life into his men by working faster than they do, and this quality is rarely combined with the painstaking care, the neatness and the conservative judgment demanded as the third, fourth and fifth requirements of a gang boss.

Seventh.—He must constantly look ahead over the whole field of work and see that the parts go to the machines in their proper sequence, and that the right job gets to each machine.

Eighth.—He must, at least in a general way, supervise the timekeeping and fix piece-work rates.

Both the seventh and eighth duties call for a certain amount of clerical work and ability, and this class of work is almost always repugnant to the man suited to active executive work, and difficult for him to do; and the rate-fixing alone requires the whole time and careful study of a man especially suited to its minute details.

Ninth.—He must discipline the men under him, and readjust their wages; and these duties call for judgment, tact, and judicial fairness.

It is evident, then, that the duties which the ordinary gang boss is called upon to perform would demand of him a large proportion of the nine attributes mentioned above; and if such a man could be found, he should be made manager or superintendent of a works, instead of gang boss.*

In addition to being very complex and difficult, the foreman's job has a very close resemblance to some of the things which in government we have for generations fought about, and in which we have long since triumphed over the old idea. English and American history was made up for centuries with the struggle of man to get the responsibility of government divided so that the same man was not judge, jury, executioner, and often the one offended against. Thus the English yeoman, after centuries of struggle, got a jury of his peers to stand between him and his lord and give him a square deal. Yet here in the factory we have reconstructed in industry the old tryanny. Offence must often be offence against the foreman. He decides what the penalty is and levies it with all the arbitrary authority of the old-time lord, subject always to the temptation to use the unjust and oppressive method of the old system. This is unfair as a human relationship, but the new point of view is that it is also apt to be quite unprofitable from the standpoint of the works.

*Paper No. 1003, p. 1389, American Society of Mechanical Engineers.

Under the military system of management, whereby one man has practically the whole thing, we get a job so complex that it violates the four great rules for efficient work as laid down by Mr. Taylor:

First.—A large daily task.

Each man in the establishment, high or low, should daily have a clearly-defined task laid out before him. This task should not in the least degree be vague nor indefinite, but should be circumscribed carefully and completely, and should not be easy to accomplish.

Second.—Standard conditions.

Each man's task should call for a day's work, and at the same time the workman should be given such conditions and appliances as will enable him to accomplish his task with certainty.

Third.—High pay for success.

He should be sure of large pay when he accomplishes his task.

Fourth.—Loss in case of failure.

When he fails he should be sure that sooner or later he will be the loser by it.*

Mr. Taylor pays his respects to the military system as a source of confusion in the following words:

Under the military type of organization, the foreman is held responsible for the successful running of the entire shop, and when we measure his duties by the standard of the four leading principles of management above referred to, it becomes apparent that in his case these conditions are as far as possible from being fulfilled.

The first of the four leading principles in management calls for a "clearly defined and circumscribed task." Evidently the foreman's duties are in no way clearly circumscribed. It is left each day entirely to his judgment what small part of the mass of duties before him it is most important for him to attend to, and he staggers along under this fraction of work for which he is responsible, leaving the balance to be done in many cases as the gang bosses and workmen see fit.

The second principle calls for "such conditions that the daily task can always be accomplished." The conditions in his case are

---

*Paper No. 1003, p. 1368, American Society of Mechanical Engineers.

always such that it is impossible for him to do it all, and he never even makes a pretense of fulfillinig his entire task.

The third and fourth principles call for high pay in case the task is successfully done, and low pay in case of failure.

The failure to realize the first two conditions, however, renders the application of the last two out of the question. The foreman usually endeavors to lighten his burdens by delegating his duties to the various assistant foremen or gang bosses in charge of lathes, planers, milling machines, vise work, etc. Each of these men is then called upon to perform duties of almost as great variety as those of the foreman himself. The difficulty of obtaining in one man the variety of special information, and the different mental and moral qualities necessary to perform all of the duties demanded of these men has been clearly summarized as follows:

These nine qualities go to make up a well-rounded man:

Brains.
Education.
Special or technical knowledge; manual dexterity or strength.
Tact.
Energy.
Grit.
Honesty.
Judgment or common sense.
Good health.

Plenty of men who possess only three of the above qualities can be hired at any time for laborers' wages. Add four of these qualities together and you get a higher-priced man. The man combining five of these qualities begins to be hard to find, and those with six, seven, and eight are almost impossible to get.*

The Division of Labor.—Mr. Taylor gets out of this dilemma of the demand for genius by a very revolutionary and yet a very simple means. It is revolutionary because of newness to this phase of factory work, simple because of its antiquity, being nothing more nor less than one more application of the century-old idea of the division of labor. Modern industry began by an enlargement of the division

*Paper No. 1003, pp. 1388–9, American Society of Mechanical Engineers.

of labor. Partly by that means has the great increase in production of the last century come about. Therefore, we see the soundness of Mr. Taylor's plan of subdividing the work of this apparently simple task of the foreman of the military type, who is the complete and only boss of the men under him. He calls it functional foremanship, and in his ideal factory, instead of having a man responsible to one boss, he is responsible to eight bosses or foremen, who divide up the task and thereby increase the efficiency of its operation.

The Planning Department.—The first great break he makes is in separating the actual physical work and the plan of the work. He tells how this matter was driven sharply into his mind by witnessing an earnest discussion on the floor of a machine shop between the foreman, superintendent of the works, one or two skilled workmen and a draftsman. They spent an hour marking up an engine cylinder with chalk, making diagrams on the floor, and settling a matter of work planning which should have been settled elsewhere in less time and with no cessation of work. The idea of a planning department tends to be a bit revolutionary to persons who have not thought of it, but the reasoning is sound. The planning must be done somewhere. Why should workers stop their work to plan? The tasks of working and planning are entirely different, and it fits exactly into the whole idea of division of labor that the planning should be done by one man and the working should be done by another. Accordingly, the planning is carried off to a department which has almost identical relations to the work that the drafting-room has. Owing to the special nature of the making of drawings, there has been no temptation to ruin that work by combining it with

the work of machines, and so we have long had drafting-rooms. Here the designs as called for by orders, and converted into specifications for the designing department, are by the draftsmen converted into the forms of drawings and blue-prints. Instead, however, of handing the drawings and blue-prints to the shop foreman, for him to pause over, think about, and plan about, they go next to the planning-room, where they are carried on one step further. In this new department they are reduced to definite instructions for the actual producer, so that when the workman comes to a certain piece of work he has an instruction card, which readily tells him what to do. This matter of the planning department of a works is very much like the general staff of an army. The general staff makes plans for the military work that may be undertaken. Thus, the German generals, who started toward Paris in October, 1914, were not busy planning any campaigns. The campaigns had been planned for a dozen years, perhaps for fifty. These plans had been worked out with the greatest care, and often by a group of men doing nothing else for years. When the time to fight arrived the plans were taken and executed without question by men who, while familiar with the plans, may have had nothing to do with their making.

In this connection there is a well-known story of Von Moltke, the great campaign planner (*i. e.*, field marshal) of 1870. It is related that some one had an appointment with him on a certain day, which happened to be the day after the declaration of the war with France. It was an important engagement for the civilian, and, while he had no idea he would get to see Von Moltke at all, he thought he would try. He expected to find him in the midst of a great hub-bub of rushing orderlies and waiting generals, and struggling with

more work than ten men could do. Instead, he was ushered at once into the presence of the marshal, who sat alone in a big office, smoking a cigar and reading a novel. His generals and orderlies were far away carrying out plans that were as thoroughly matured as a printed railroad ticket. A railroad ticket and a railroad time-table are high models of planned operation. That is the ideal of the machine shop, when the planning department is working properly.

The planning department has three types of work: first, that of the instruction card man, who prepares instruction cards for the workers. Here comes from the designing-room a bunch of blue-prints calling for certain machines or groups of machines. The next form which this order takes is a collection of instruction cards, each of which calls for a certain part. How does the workman know what to do? The instruction card tells him to take a certain piece of material, certain tools, set them a certain way, cut to a certain depth, run the machine at certain speeds. With the instruction card he knows what to do.

The second group of workers in the planning department is the route clerks, or order-of-work clerks. They take these instruction cards and deal out the work to the man and to the machine, so that when each man comes to his machine there is a list of work that he is to do or that the machine is to do.

Thirdly, the cost and time clerks see that the necessary records of men and jobs are kept, so that pay and cost matters can be kept straight.

The Factory Bosses.—The three-functional foremen of the planning department have little to do with the man at the machine, but it is plain that they prepare things for him, and any of them may come to settle uncertain points

in an instruction card. However, five men regularly come into personal contact with the man at the machine.

First.—The *gang boss* has charge of the preparation of all work up to the time that the piece is set in the machine. It is his duty to see that every man under him has at all times at least one piece of work at his machine, with all the jibs, templets, drawings, driving mechanism, sling chains, etc., ready to go into his machine as soon as the piece he is actually working on is done. The gang boss must show his men how to set their work in their machines in the quickest time, and see that they do it. He is responsible for the work being accurately and quickly set, and should be not only able but willing to pitch in himself and show the men how to set the work in record time.

Second.—The *speed boss* must see that the proper cutting tools are used for each piece of work, that the work is properly driven, that the cuts are started in the right part of the piece, and that the best speeds and feeds of cut are used. His work begins only after the piece is in the lathe or planer, and ends when the actual machining ends. The speed boss must not only advise his men how best to do this work, but he must see that they do it in the quickest time, and that they use the speeds and feeds and depth of cut as directed on the instruction card. In many cases he is called upon to demonstrate that the work can be done in the specified time by doing it himself in the presence of his men.

Third.—The *inspector* is responsible for the quality of the work, and both the workmen and speed bosses must see that the work is all finished to suit him. This man can, of course, do his work best if he is a master of the art of finishing work both well and quickly.

Fourth.—The *repair boss* sees that each workman keeps his machine clean, free from rust and scratches, and that he oils and treats it properly, and that all of the standards established for the care and maintenance of the machines and their accessories are rigidly maintained, such as care of belts and shifters, cleanliness of floor around machines, and orderly piling and disposition of work.*

The eighth of the functional foremen, and the fifth and last of those regularly in contact with the men, is the dis-

*Paper No. 1003, p. 1392, American Society of Mechanical Engineers.

ciplinarian. Instead of letting each foreman settle his own matters of discipline, with the necessary confusion of fact, feeling and prejudice which arise, here is a man who keeps such matters straight, a kind of works policeman, or, better still, a works judge. It does not make much difference to him if Pat, the workman, is an Orangeman, and Mike, his immediate foreman, is the other kind of an Irishman, although this fact between these two men might work into a considerable possibility of friction, if they rub against each other hour after hour, day after day. He sees them so little that the opportunities of friction are removed, and then, too, since it is his job to settle differences, he is the kind of man who can work at the matter judiciously. Furthermore, it is his task to keep records so that every man is really known. In time the collections on his cards give a considerable history of each worker. A good disciplinarian can answer questions concerning a man's desirability for promotion, and do the disciplinary work far better than could fifty foremen in different parts of the plant.

The Advantages of Functional Foremen.—The great advantage of the functional foremen is the well-known advantage of the division of labor. The task is easier to learn, it takes less time, and, because of its greater simplicity, greater speed and efficiency can be obtained, but, above all, great emphasis should be laid upon the point brought out in Mr. Taylor's presentation of the nine qualities of the worker. The ideal military foreman with ten men under him has the demand for qualities almost great enough to make him a factory superintendent. When his job is divided up among eight men, it becomes at once vastly easier to find men with proper combinations of qualities. They do not need to be nine-quality men. Two

qualities, three qualities, four qualities, five, or six, suffice. That rare genius who has the nine qualities can go ahead and be a railroad president or factory superintendent or fill some other of the places that require a very peculiar kind of man. The old-fashioned military foreman is a little like the successful operator of a hen farm. There's a lot of money in hens, as you can easily find out by multiplying the profits of one hen by thousands or ten thousands, but the vast amount of detail in hen farming is such that the man who can operate a ten-thousand hen plant can also operate a railroad and make twice as much money. So the few ideal military foremen are needed on bigger jobs, while men of narrower equipment under functional foremanship carry on their work much better.

There is an essential violation of human nature in demanding that a good, pushing hustler who would make an ideal speed boss shall be bothering his head making out instruction cards which involve careful thought and planning. The military foreman is practically compelled to do both. Under the functional system these two types of work are done by men who may never see each other except for occasional conference as to the *details* of a card.

The Quickly-trained Worker.—The same advantages that have been spoken of with regard to management and foremanship hold with regard to work. The old-time machinist knew how to do many kinds of work, was a highly-skilled person who had to spend much time in his training. By the time a machine shop has been put on functional foremanship, with its careful instruction cards, most machine work can be done by men who a few months before were unskilled laborers and have now learned a simple process of doing a special kind of work. This results in

the increase of the wages of a lot of men who had been unskilled workers and a decrease in the wage cost of many classes of work. It contains also the very grave danger of reducing the total number of highly-paid men. This is a danger from the standpoint of workers and an advantage from the standpoint of the works. The charge that modern systematic industry is turning men into automatons is hotly contested, but there is a great deal to be said on both sides, and it is a field in which our knowledge, unfortunately, is as yet much too limited. (See the testimony of men in chapter on "Man and Job.")

The third advantage is the fact that the planning department tends to become standardized; thus a plant like the Link Belt Works, an engineering company in Philadelphia which makes conveyor apparatus to pile up coal, elevate or carry barrels, and do everything in the line of conveying crude materials, gets, as it proceeds with the work, a vast number of standard units of links, bolts, and pieces, so that when a special order comes in it merely becomes the question of combining standard things kept in stock, much in the same way that a grocer would fill an order for cans of this and that and pounds of the other. The fact that these units are made constantly by the same group of men greatly favors this standardization, which is in itself a great cost-reducing factor.

Attitude of Employers toward Functional Foremanship.—In the introduction of functional foremanship Mr. Taylor and other engineers have found that they run against two deep-seated prejudices. First is the prejudice of the practical man against what he calls the non-producer. A man at a machine turns out pieces of physical stuff. He is a "producer." The man in the drawing-room

makes blue-prints. The man in the planning-room makes instruction cards, computes costs, arranges work for machines. What is the result of his day's work? Nothing tangible. He made no piece of the machine. He is a "non-producer," so called. The "practical" man has a hard time in tolerating enough non-producers to make the cost as low as possible, and there is, of course, always the danger that the non-producer may be doing work that does not amount to anything. It is easy to let a notion get away with you.

The second prejudice that functional foremanship strikes is that it violates all our proprieties of authority. The idea of the military foreman makes a strong appeal to the average mind. "There you are, foreman. There are your men. Make good or get out. Make good or fire them." It is all so deliciously simple. When you try to tell the factory owner about these eight functions and these eight men, he says all idea of responsibility is gone. He says authority is gone to the winds. He can't stand for it. It won't do; he knows it won't do. It violates one of his prejudices, and that settles it. So great an objection is this that Mr. Taylor himself never dared explain it to people into whose works he proposed to introduce it. They had faith in him because of his results. They were highly pleased with his work, but they could not stand for this functional foremanship, because it violated one or more of their fundamental prejudices. He tells the amusing fact that he has put it in, had it working for years, had people pleased with it, and then when he explained it to them they went up in the air in a high state of excitement. The thing worked all right, but the theory of it wouldn't do. Consequently Mr. Taylor practically had to

sneak it in first and explain later. There's a bit of human nature for you, and don't be too sure that you yourself won't do that very thing some time, somewhere.

The trouble with these matters of producers and non-producers and the functional or military methods of management is that they are abstract problems, and it is a fact that the "practical" man who has dealt for years with concrete questions gets out of the habit of thinking on abstract questions until, to many men, this becomes virtually impossible, especially when dealing with any of the things he has handled specifically and concretely for many years. Who that has talked with the manufacturer has not been told something like this—"Well, that's all right for philanthropists and altruists, but we are practical men"? If any one doubts this point, let him, for example, try to talk to an American manufacturer about any phase of the tariff which happens to disagree with the side in which he believes. The attempt to get him to recognize any such abstract point or general point of view, regardless of the weight or validity of that point, is usually little short of ludicrous. It is a fact, however, that scientific management demands the ability to recognize, think in, and use abstract ideas to an increasing extent.

The Results of Planning Department Work—Go into a plant that is working under functional foremen with a good planning department and ask something. You will begin to appreciate more nearly what it can do. When, for example, will this order be done? As a result of time study and standards that have been made months ago, instruction cards with approximate records of time to be consumed have been made out for the order. The various machines have pegs which represent them, and on these

pegs hang the work that is to be done. The clerk can run down the line, look over the pegs, see how many hours of work are ahead for a certain machine before it gets to the piece in question, and in a short time you can know within a day, or perhaps even a few hours, when a certain thing will be done, because the work is planned not only for every order, but for every machine.

How many 3-inch bolts, one-half inch in diameter are there in stock? You go to the stock-room and go to a bin with two or three numbers for its name. Those numbers tell two things: first, the location of the bin; and, second, what it contains. They tell the location as does a street number. Thus any who are familiar with the map of the city of Washington know at once where 1427 P Street, N. W., is, because there is system in the use of figures which tells the whole story—the quarter of the city, the number of squares north and west of the dividing street, the street, the block, and the side of the street. Similarly the store's clerk walks in among the avenue of boxes which are numbered, as are the houses, as to location, and the boxes are further marked as to contents. On the bin is a card which shows that the box contains 310 of these bolts. The young man takes out 25, subtracts from 310, leaving 285. Above on the card are the figures 300 and 800, which means that whenever the number runs below 300 the store's clerk is to report to the purchasing department the exact number in hand, and he will automatically raise the number to 800. This does not mean that the matter goes to the attention of the head of the purchasing department, because his job is to make purchasing arrangements. He may have arranged a year ago to buy these bolts under certain specifications from a certain firm. The clerk in the purchasing depart-

ment has a record of that fact. When he gets information that a certain bolt is low, he mechanically puts in an order, just as a hostler feeds a horse in the evening. Thus the purchasing department might run automatically for months with the head of it away. That is the theory of all departments of such a works. *The work is planned.*

What has this order cost? The cards in connection with this order carry on their face the requisition for materials with rates, for machines with their time, for machinists with their time. When the machinist turns in his instruction cards as the basis of pay, the cost of the order is automatically carried, so is the machinist's time. Only some adding is needed.

The plant that has a planning department is enabled to let the management take a snapshot, so to speak, of the state of the work, just as the bank president can take a snapshot of the financial status of his bank every evening when the books are balanced.

I must here call attention to the fact that in this above-mentioned accuracy of cost there is the usual possibility of error that is likely to enter into all costs. Costs depend upon certain assumptions, and the actual cost of operating a machine, while it may be fixed arbitrarily by the cost department, actually varies from day to day because the primary cost elements differ but little whether one hundred machines are running, or ninety-seven machines are running, or whether forty-seven are running. Power, light, heat, superintendence, water, taxes, interest, and many other things tend to be constant, although the number of machines that they operate may vary. It is plain that it costs less to operate one of one hundred when all are busy than to operate one of one hundred when half are idle.

What shall we assume to be normal? In this phase of costs we have another excellent illustration of the fact that in cost keeping, as in nearly every other human relationship, the results depend upon the assumption with which we start.

Opportunity for the Worker to Rise.—How do men rise? They must convince people who have positions to fill that they are able to qualify. One of the best ways to do this is to fill to overflowing the job you have. Thus we rise by showing somebody that we have capacity our job does not use. In the functional shop you have about eight chances to show somebody, because there are theoretically eight foremen who come in some contact with you. In the military shop there is one. And it is very easy for a personal matter, mere natural differences of disposition and personality to make friction or an unsympathetic situation, so that the foreman just naturally will not promote men under him. Perhaps jealousy will cause him to keep down men whose greater ability might threaten his position. These things are much less likely to happen with many foremen than with one. The old-fashioned foreman bossed and called you down. The functional foreman teaches and shows you how, and then, above all, is the fact that the job is simpler and easier to learn. Consequently the opportunity to rise seems, beyond a doubt, much better in the scientifically-managed plant with functional foremanship than in the plant having the old-line or military type of organization.

Any person who is particularly interested in this matter should read the one great book on the subject; namely, F. W. Taylor's "Shop Management," Paper No. 1003, American Society of Mechanical Engineers, reprinted by the McGraw Hill Publishing Company. It should never be lost

sight of, however, that this book was built upon the experience in a machine shop doing varied work. Naturally, therefore, the relation of planning and superintendence was vastly greater than in many lines of straight manufacturing. I have had some almost humorous experiences teaching young men this book, taking them into a screw factory and asking how much of it applied. They found that very little of it applied, chiefly because most of it was already applied in the fact that the automatic machines doing the work practically represent the extreme from Mr. Taylor's ideas. The ultimate end of standardization is an automatic machine, and the planning department is thus partly removed to the place where machines are made. Again, there is apt to be a confusion in the mind of the reader when he reads of eight functional foremen. He thinks that the principles are applicable only to great works. Note the word *functional*. I knew an office that had a very considerable number of functions, thoroughly separated departments. The entire office force consisted of the owner of the works and the stenographer, and the entire works was operated by six men, but functions and departments were there, and it was working efficiently and well. Remember that a squirrel has as many legs, bones, and organs as the draft-horse, with a difference in gross size and in the relative development of different parts. So the functions of well-organized industrial works may vary. They are developed to do their particular tasks, as are horses' legs and squirrels' legs.

CHAPTER XXII

Reorganizing Works

The *words "efficiency"* and *"scientific management"* have been terms to conjure with for the last few years. They have attracted world-wide attention and have resulted in a vast amount of effort, some of it successful, much of it unsuccessful. One of the common ways for the unsuccessful effort to operate is for a regular staff that operates a plant to conclude that they will establish a new and more efficient system. If they have been doing good work at running the plant, they have not time to put in the efficiency system. If they can put in the efficiency system, they have not time to run the plant while they are doing it. Consequently a small army of "efficiency engineers" has arisen. Some are sheer impostors, some are good tinkers, some are good workers, and some, such as the Taylor group, do a systematic rebuilding from the ground up. Manifestly it is for most plants quite impossible to permit the thoroughness of overhauling that the installing of anything like the Taylor system involves. It is costly in cash and in time. This puts a strong temptation in the way of the man who thinks of a home-made job. It is easy for an outsider to make plans, but it is difficult for him to make them so thoroughly and so well that they will really run, particularly because of certain frailties of human nature. Many a perfectly good system has been put into a works and failed because it fell into the hands of persons who were not in sympathy with it. One of the surest ways to get the sympathy of a man for a thing is to have him respon-

sible for it, and one of the easiest ways to make a man unsympathetic is to allow him to have nothing to do with the incorporation of a plan. This accounts for cases where efficiency systems put into works have done fairly well while the installing force ran them, but when it went out, somehow, the soul went out of the system. Why did it fail? "I can't tell you," somebody says. "It wasn't my plan. I didn't exactly understand it. I wasn't asked." And then the man who "wasn't asked" sees with glee the failure of the thing that was put in by the man who didn't ask him. Consequently there have been a rather discouraging percentage of failures following very thorough overhaulings of industrial works, and also following similar thorough overhaulings of offices. Two points of human nature come in to explain this. One is the pig-headedness of the successful man. It is generally agreed by the writers on this subject that they have more difficulty in persuading a superintendent or foreman than the workers. A superintendent or foreman has attained his position because of push, persistency, and force. Why should he change plans that have succeeded? Plainly there is no good reason why he should, so he receives the efficiency engineer with a perfunctory welcome, and never sympathizes with the remaking that the efficiency engineer gives. Another point of human nature which tends to make trouble just here is that of our inborn egotism which makes us want to do things our way whether it is better or not. Here is a good
system. A new man comes along.
culty in feeling he is alive
to that system. He change
not. Herein lies one of

Go Slowly.—On

engineers are agreed is the necessity for going slowly and going thoroughly. They are in the face of the enemy, and if they do not instil confidence by showing that they know what they are doing, woe unto them! They are under suspicion because they are outsiders, because their plans are supposed to upset the existing plans which have been made by the folks at home, and then, too, they have the great handicap of being new. We all resent new things at some phase or other.

To overcome these difficulties Mr. Taylor emphasizes the importance of beginning with material things, not people; devoting your time to the standardizing of standards, time study, working out the handling of work, making out tickets, rearranging machinery, planning methods of work. Get people acquainted with you by slow [illegible]. As an evidence of what he means by standardizing standards, I refer to the story he tells about the cleaning of a certain set of boilers in a plant in which he worked. It [illegible] to take a good while, but the work was done by [illegible] men. Mr. Taylor concluded he would study the art of cleaning boilers, so he did it himself once. He found he had to work in a very cramped position. It hurt him to lie on sharp pieces of iron, so, to the great amusement of the [illegible] he made mattresses to lie on. He found he spent a lot of time reaching and hunting for tools, so he made [illegible] and placed in them tools that were needed. When he had finished he knew it needed to be done in a certain way with certain tools, mattresses, and in certain order. All [illegible] written out in great detail, making [illegible] [illegible]s. The old-timers laughed at him and all [illegible] [illegible] the [illegible] [illegible] [illegible]

[illegible] quality is [illegible] At [illegible] What shall be [illegible] is allowed [illegible] are some of the variables [illegible] of these questions [illegible] the question [illegible] namely, the [illegible] Taylor, published by the Ameri- [illegible] under the title of [illegible] is adequately [illegible] experiments. That [illegible] of certain [illegible]. By [illegible] and it had to cut [illegible] of pieces of uniform [illegible] This is the number of these [illegible] different kinds of machines, [illegible] machines, a [illegible] was spent [illegible] experiments were made, the [illegible] figures plotted in curves, [illegible] of analyses and much [illegible] mathematician, reduced these [illegible] formulae and, finally, best of all, to [illegible] This simple mechanism per- [illegible] the various parts of [illegible] would a [illegible] a certain figure as a [illegible] the machine accordin[illegible] of result which we

by any machine, but by any man. [illegible] all the thousands of experiments [illegible] could not set a machine by guess [illegible] of error. The result of Mr. Barth's [illegible] various shop rearrangements was an increase [illegible] 200 to 900 per cent. per machine. [illegible] study in standards, and the [illegible] are within the reach of the works [illegible] as the results of Sir Isaac Newton's [illegible] most abstruse mathematical [illegible] the world through a simple instrument [illegible] mariner to locate himself at noon [illegible] sun, the surface of the sea, a [illegible] sulting some tables.

The First Actual Contact with the Man [illegible] installing of a new works system [illegible] given to the material things [illegible] been rearranged and regrouped [illegible] tion of making men apply [illegible] the inspection system. [illegible] tends to bring trouble. [illegible] ning, the next place to begin [illegible] can be obtained, and, above [illegible] slowly. Get him satisfied [illegible] others, who will gradually [illegible] And, above all, do not make [illegible] delay than an order given [illegible] work.

[illegible] some men who [illegible] will break [illegible]

ber that it is a great calamity to a man to be too high up, perhaps even a greater calamity than that he should be low down. If there is a lot of routine, it should go to a man who is barely good enough to do it. Otherwise, it may pall on him. The varied job should go to the man who is too good for it. He will learn it and perhaps pass on.

The Efficiency Fakirs.—The great interest that has been given to the idea of efficiency in recent years, especially the large amount of newspaper emphasis, has caused it to be in every man's mind, and, as is the case with most new things, has given rise to a great horde of quacks and fakirs. So great has been this outbreak of inefficient efficiency men, that the admission that you are an efficiency engineer is enough to cause you to be shown to the door in many, many places. Men have claimed the title who had no more right to do so than they had to say they were doctors of medicine. Yet they have gone about hunting clients and pretending to do business. Unfortunately, the inefficiency of some plants has been so great that many of these "efficiency engineers," quacks though they are, have been able to make improvements easily worth more than their fees.

There are two great names which stand out in the field of efficiency engineering in America. They are Frederick W. Taylor and Harrington Emerson, men of very different experience and type and method. Taylor was a graduate mechanical engineer, who worked for years in various machine shops, actually solving problems, and he is regarded the world over as by all odds the greatest scientific worker in this field. Most of the standard books of creative work have been written by Mr. Taylor, or those who worked immediately with him. While Mr. Taylor was a man of experience as an engineer and a solver of problems, he had

little experience in systematic presentation, or in the philosophic aspect of the matter. Consequently the philosophy of industrial management is yet to be written. Mr. Taylor's books are rather hard to read, but full of meat. Being scientific, however, his system of works reorganization has been most thorough. It throws things out from the ground up and builds anew. It costs money; it takes time. Few can stand the expense, and when done it is so elaborate that some cannot continue it.

Mr. Emerson is a contrast to Mr. Taylor at every turn. In youth he travelled widely in Europe. In young manhood he was a professor in the University of Nebraska. He went West into real estate ventures, and made a fortune. He "roughed" it through the Klondike gold rush of 1897–'98. Then he began to report for European investors upon the soundness of American enterprises as subjects of investment. This caused him to examine many plants, and he soon began to see how some were more efficient than others, and wherein they were efficient and inefficient. He has more the instincts and experience, therefore, of a reporter than of a scientist, of a salesman rather than an engineer. He is distinctly more philosophic than Mr. Taylor. His best-known book is entitled "Twelve Principles of Efficiency." Any plant is efficient, he says, which has these twelve principles in operation:

> (1) Clearly-defined ideals; (2) common sense; (3) competent counsel; (4) discipline; (5) the fair deal; (6) reliable, immediate, and adequate records; (7) despatching; (8) standards and schedules; (9) standardized conditions; (10) standardized operations; (11) written standard-practice instructions; (12) efficiency reward. Most of these are not by any means peculiar to scientific management, nor can it be said that Mr. Emerson's application of them is distinctively original.*

* "Scientific Management" (p. 21), by C. Bertrand Thompson, turer on Manufacturing in Harvard University.

When it comes to assisting a works manager to renovate a plant, Mr. Emerson's system is very different from Mr. Taylor's. Mr. Taylor would practically put out the existing management and run the plant during the time of installation, and then hand it over finally with the complete new staff. It might include, of course, many renovated men in the old staff. Mr. Emerson, on the contrary, leaves the staff as he finds it, and, by expert assistance here and there, bolsters up the weak points and makes improvements gradually. Perhaps he might be called an evolutionist, whereas Mr. Taylor was almost a revolutionist. He certainly takes Mr. Taylor's point of beginning where you can show the greatest results. As an example of this, he was called to a great publishing plant engaged in the periodical business. The pressmen were taking big rolls of paper, such as most of us have seen in wagons along the city streets, rolls four or five feet long and two and one-half or three feet in diameter. In opening the rolls ready for the press, the foreman would take his knife and cut the outer sheets, perhaps cut five or ten sheets of paper, each five feet wide and eight or ten feet long when unrolled. Doing this thing hour after hour, day after day, the wastage in paper amounted to thousands per year. Plainly, the young man put at the task of devising a means whereby the men could learn to make a more economic cut, and establish an inspection system to see that it was carried out, was saving several times his salary.

As between the Taylor and the Emerson systems, the latter is plainly the more opportunistic and less thorough method, and it is one much more within the reach of the average American manufacturer. Furthermore, the fact that Taylor's system was evolved in machine shops causes its application in other types of plants to be an entirely new

problem. But it should not be overlooked that the principles laid down by both Taylor and Emerson are in most cases of universal application.

Mr. Emerson's "take-hold-where-you-are" system is certainly a much better one as a basis of seeking customers. Where the Taylor system would cost $100,000 to install, Mr. Emerson could give you $5,000 or $10,000 or $15,000 worth of help, according to your ability to pay.

The Committee System.—Mr. C. E. Carpenter, in his book, "Profit-Making Management," gives full credit to the forces of conservatism and lack of sympathy, above mentioned, as factors in wrecking attempts at factory reorganization. The way they produce failures, he says, is through failure to produce the proper co-operation. To get co-operation he has worked out a committee system, evidently for plants in which the organization is still more largely military than functional, but the principle involved is applicable in many types of organization.

The main objects of his committee system are two: first, to get men into a spirit of co-operation; and, second, to focus the combined abilities of many minds upon one problem. It is beyond a doubt true that several heads are better than one. Mind sharpeneth mind, and alone we tend to stagnate. It is surprising how little one mind can see out of the straight and beaten path. We can see this by noticing the slow growth within our minds of ideas which we at last come to recognize as the large results, but simple, that have grown from a small beginning through a long period of time. The history of the development of many important things, mechanical and intellectual, shows how important have been the exchange of ideas among groups of people. One man gets part of an idea. That reminds another of something,

and between them they bring it out to a perfection which neither alone could have attained. An army is run not by a general, but by a general staff, in which groups of men discuss and work out plans.

The General Factory Committee.—In the process of Carpenter's development of coöperation and stimulus through conference he has fixed a general factory committee, consisting of the designer, head of the cost department, head of the tool department, the superintendent, and such foremen as seem to belong there. General plans, general economics and the programme of the works and the orders are discussed. Matters of the promotion of men also are settled here. Such a committee requires a secretary using shorthand, who serves as the memory of the committee between times and can be consulted on all occasions as to what the committee really did.

Subsidiary committees come under this general committee, one for each important line of production. The chairman of each committee should be a member of the general committee. On each subsidiary committee should be all the foremen concerned in the getting out of this particular product. This committee handles such questions as new devices, and the development of standards, any economies of production, increases in the effectiveness of routine, progress of improvements in plant or product or method.

Mr. Carpenter even goes below this, and has each foreman have committee meetings occasionally with the subforemen, who come into actual contact with the men. This idea is a recognition of the fact, too often overlooked, that, after all, the most important man in a plant is the last foreman who represents the management to the individual worker. That is the real point of contact between plans

and production. That is where the real battle of success is fought out. The necessity of keeping these men in the proper frame of mind, properly instructed, properly informed, can with difficulty be overestimated.

The General Foremen's Committee.—Mr. Carpenter also recommends one more committee; namely, a general committee, which meets monthly and consists of practically all the foremen in the works. This committee is particularly efficacious as a kind of fault-finding agency. A representative of each department is called upon for a report as to the state of his department, particularly as to his reasons for any delays or unsatisfactory condition in the getting out of product. I must confess that if I were foreman I should tremble in such a committee, because here the truth has got to come out. Somebody is responsible, and each person who might be responsible is there, desirous of passing responsibility on to somebody else if possible, but the other fellow is right there, and the man who tries to pass on responsibility that is properly his is decidedly up against it. It is an easy matter to tell one side of a story, to tell a superintendent how somebody is at fault, when he is not present. It is a very different matter to tell the whole group that John Jones is at fault, when John Jones and his friends are in the group and the facts are available. Such a meeting is a great clearer of the atmosphere. Where groups of men get together in effort, jealousy is apt to creep in, and fault-finding and backbiting are all too common, but where there is a monthly foremen's committee meeting, that is the place for clearing of troubles. The opportunity for the small fault-finder is not good. People do not like to hear him, but in many cases they can't help themselves. The monthly committee meeting excuses them from listening to such things

between times. The complainant can just be invited to bring his complaint to the monthly meeting. In other words, to quote the vernacular, he is invited to "put up or shut up." Of course, if he does not put up, he is a small back-biter, with no ground to stand on, and if he knows he can put up in the monthly meeting, he isn't necessarily going to boil over between times.

Mr. Carpenter recommends a very efficacious device to be used at these committee meetings; namely, the locked blackboard. Some resolution that goes through the committee that something is to be done by certain parties is put on the board and locked shut, to come open at the next meeting. It is one thing to carry a resolution through a committee and know that it may never be called for again, and it is another thing to know that the "blamed blackboard" is going to be locked up with a record on it calling for an answer.

The Committee as a Discoverer of Men.—One of the most important services that any such committee organization can render is in making possible the promotion of the right men. Tens of thousands of men in America are leading discontented, half-lazy, half-efficient lives because they cannot get the promotions they need, or think they need, which amounts, from the standpoint of personal demoralization, to the same thing. This committee system puts it up to each foreman to make good and make a good showing. That means he is going to pick out the right workman to be his shop boss or assistant foreman, because he can't afford to pick friends of his merely because they are friends or members of the same lodge, or relatives, but because they can "make good." This fact, that a man is likely to be promoted, puts new hope and energy into him and makes

him assert himself and do his best because effort is rewarded. The plant which has some device that makes men do their best has the greatest asset that any plant can have.

In this matter of the attitude of the foreman toward his men we are often inclined to overestimate the influence of gain as a factor guiding men's actions. Man is really a very complex creature. Few things are more difficult of analysis than ultimate motive, and when ultimate motive is finally analyzed it is often quite surprising. There is a case on record of a plant that had manifest reason for the dropping of a number of men. Upon investigation it was discovered that the superintendent had long been ambitious to be the head of a thousand men. He had just a thousand, and if these eighteen supernumeraries were dropped he would not have the thousand, and would be missing his long-sought ideal. So they were kept, and the firm was paying out $40 a day from which they were getting no return, while the superintendent had the satisfaction of being chief of a thousand men, which happened to be one of his ultimate motives. I know of a foreman, excellent in every respect, sufficiently intelligent, sufficiently strong, sufficiently capable, but when it came to a choice between being a bully to some of his underlings, or keeping them and letting them make profit, it seemed he just had to be a bully. Therefore, he had to go. He is no longer a foreman.

Millions of men, and often whole races, are characterized by this inability to use properly a little authority. They want money, they want advancement, but the desire to tyrannize is to them like fly-paper to the fly: they can't keep away from it.

War serves as another illustration of the non-economic motive. Groups of men throw a nation into throes of end-

less suffering. Thousands go out and lose their lives in the defence of national honor. The gain concept has little to do with it. It may be back in the minds of those who make the war, but it is not in the minds of the millions who furnish public sentiment and the men who go out and get killed. This is another example of an ultimate motive not measured by dollars and cents. And what is honor? It is rarely profitable in cash.

Any system of factory management which for a moment loses sight of the fact that we are human beings, and very full of that complex thing called human nature, is likely to run upon the rocks.

CHAPTER XXIII

Symbols and Records

Man dominates the earth and his brother animals because he can profit by experience, and especially because he can pass on the results of experience from generation to generation. A dog or a horse can profit somewhat by experience, but very little of it can be passed on. The next generation of dogs and horses must practically begin at the beginning. Hence they bear our burdens.

Man's progress, however, is seriously limited so long as the processes of accumulation and transfer of experience depend upon unaided memory. We have lived too long in the situation referred to by the famous Frenchman, Mirabeau, who, as he lay dying, moved his head uneasily upon his pillow. The devoted attendant rearranged his pillow for him and asked if his head hurt. Mirabeau thanked the young man for his attention, and said, with a sigh: "I would that I could leave it to you." With the death of the owner of that head, vast experience left the service of man.

The development of written records to replace oral records has gone far to enable one generation to pass its work on to the living, and to enable one man to pass on to the next man a large amount of the accumulation which Mirabeau rightly regarded as hopelessly gone with himself. As our operations become larger, the human mind is entirely incapable of retaining them by unaided memory. Records must be written. We are just beginning to appreciate in industry the value of this stored experience, which can save so much remaking. We have had splendid things done in

American industry, and lost and done again and again, and still lost. The study of scientific management is rapidly getting us out of this peculiar and semi-civilized isolation, which has survived much too long. The things that are achieved are now recorded, so that all may go and learn. First comes the classification and naming of things. What have you? Where is it? How soon can you find out? What good to you is the knowledge that in a certain barrel among a thousand others is a letter that you want? It might easily take a half-day to find it. What is in your shop? Can you tell just what is there? Do you know just how many of a certain kind of pieces you have, and can you get them in a minute? The process of operating a factory consists, in part, of constantly getting pieces. The speed with which you can get them, and the accuracy with which you go about it, decide whether you have a chaos or a works. As soon as an enterprise gets to be of any size, there must be some system in the classification and naming and keeping of things. Otherwise system is impossible. It is, perhaps, not too much to say that large size has come to some enterprises because they had system which permitted control, which in turn permitted growth.

"The making of a classification is the beginning of wisdom. Without it accurate records are impossible; and where there are no records the business perishes." A distinguished professor of idealistic tendencies recently suggested to me what he thought was a new theory; that business ought to dispense with all records. Too much time is wasted, he said, in clerical work, and not enough spent on actual production. He thought it would be safe to get along without all this mere writing of history and that society would benefit greatly from the increased production.

The only trouble with this theory is that it has been tried for centuries and found wanting. Business men are to-day being forced into more and more recording, because they have found that records

are an indispensable insurance against mistakes, failure of memory, and against general human fallibility. Neglect of them means failure to get and to hold business. It means failure to work economically, and failure to deliver on time. It means inability to finance the business, because no bank will trust a concern which does not keep records. It often means failure to recover a just amount of insurance in case of fire. In a business of any size it means ultimate bankruptcy.

To get accurate records you must have classification for two reasons: in the first place, to introduce order and comparative simplicity into what is otherwise disorder and complexity; and in the second place, to identify all the elements of industrial activity.

Business activity is made up of three elements—materials, processes, and relations between individuals, the latter usually called organization. If you want to know what you are doing in your business—and if you don't the sheriff will certainly get you—you must reduce to order and identify every element of labor, every bit of material, and every detail of organization about your place, together with every relation between your business and the financial world and the market. And you can get neither order nor identification without classifying.

Consider how the natural sciences are built up on a foundation of classification. Biology has kingdoms, branches, classes, orders, genera, species, and varieties. Each individual must fit in as an individual belonging to a certain variety of a certain species of a certain genus, order, class, branch, and kingdom. Every little insect has a location all its own. This is the only scientific way through the vast complexities of living matter. There is no other way to traverse the complexities of business.

. . . .

In any concern that has passed beyond the one-man stage there must be plenty of records; to have them properly kept, classification is absolutely indispensable.

Classification and order mean, in the first place, definitions of function. Everybody knows exactly what he has to do, and how he has to do it: there is definite organization. It means definiteness of operation: everything is done at the time it should be done, in the order in which it should be done, and in proper relation to other things. It means convenience in locating the materials used and the records compiled. It makes possible accurate knowledge of costs. The disadvantages of doing without this classified knowledge are so great, and the advantages of having it are so many and im-

portant, that the question of expense sinks into the background. It is a necessary cost, like the cost of labor and materials and machines. One must expect to meet it when one undertakes any kind of business that is too big for one man's head. It goes without saying that this cost, like all others, must be kept as low as is consistent with real efficiency.

After the introduction of order the second function of classification is the identification of the elements and the combination of labor, materials, and organization. It is a curious fact that mere names are not sufficient for definite identification. Language has not grown so fast as the facts with which humanity has to deal. Consequently names are considerably overworked. They are ambiguous; they may at once mean two or three or a dozen or twenty different things.

The fact is that names get a definite meaning only from their context. The context is itself a part of the name; it is the significant, defining part. The usual way to get sharpness and definition is by a long, roundabout qualification and description. The short, direct way to provide a context which will make names significant, definite, unmistakable, and intelligible is classification.

Suppose you are doing business with twenty thousand customers. There are perhaps two hundred Smiths among them. You classify them first by their initials. But there are probably a number with the same initials, and some perhaps with even the same full name. You do not depend on their names alone; you have their addresses, and by supplying your customers with a context by their location, the state, city, street, and house number, you can ship and bill them without mistake. You identify them by this system of classification.

Your foreman sends in a requisition for five hundred feet of "tubing." This does not mean anything until you know what it is for. If you are in the automobile business and the tubing is for coat rails, it may be brass; if for acetylene feed pipes it will be rubber. You must classify.

. . . .

The type of management also cuts a figure. Under the ordinary rough-and-tumble organization almost any classification will do. If such a management had a good system it might not know how to use it. As the management improves, the best methods become more worth while. Only the best type of management makes the most of the best system. It takes a high grade of ability to develop and to

use a complete, logical, and practical classification. Unless the management has that ability, or can hire it, it would do better to be modest and take its chances with a less elaborate scheme of classification. This is a hard saying; but business is frequently hard.

The two controlling considerations, however, are the necessity of insurance against error, which has already been discussed; and the incentive to standardization which invariably accompanies the effort to classify details. *Standardization* is here used in the special sense of *the determination of the best method or the best material to use for any given purpose, and strict adherence to that best as the standard until a better is found.* You do not want to classify things and put them down in permanent records until you are satisfied that they are the best known for the purpose. You begin to standardize at the same time that you begin to classify and record.

This by-product of classification is of the utmost importance, and it is a safe prophecy that it alone, in the hands of a competent and wide-awake management, more than pays for the cost of even the most elaborate system.

. . . .

The correct method of classification is summed up in two words: analysis, the enumeration of elements; and synthesis, the regrouping of details."*

The above quotations are part of the introduction to a presentation of accurate details of a certain classified system. It is not the purpose of this book to go much beyond principles into details, because of the limitations of space. The general system of making classifications does, however, belong here. One that is almost universally found efficient is the system which is known as mnemonic, in which we have two factors: first, the mere name for a certain thing; second, the make-up of the name itself, which signifies something, as in the case of the city house referred to in a previous chapter. Thus, John Johnson is a name, and in the Swedish system it means John, the son of John. So the number 973 might mean a 973d unit, or the figures might be

*"Scientific Management," C. B. Thompson, pp. 461–5–6–8–9–70.

loaded so that they meant something else. I walk into a library with a million books. I see one marked 973. I know at once, through a little familiarity with the Dewey system of classification, that 900 means history, that 70 means history of North America, that 3 means history of the United States. Therefore, 973 says to me, "This book is a history of the United States." Further figures carry the classification on down more closely, and finally come some letters indicating the author's name. This is an example of a very elaborate and carefully worked-out, indefinitely-wide system, which uses decimals from 1 to 1000, with their subdivisions, and has room for absolutely indefinite expansion. The fields of knowledge are classified into great groups: 9 for history, 8 for literature, and so on, and finally one group for miscellaneous. Then, carrying the figures on down, they are capable of the addition of indefinite numbers of decimals, so that we might get a number such as 973.247.21 M. N. Some such system as this permits, if need be, anybody to make any kind of classification to cover his particular enterprise in any or all of its expansions. Employing a similar system, Mr. F. W. Taylor and his associate engineers have made, with the combination of figures and letters, a very elaborate file to enable them to keep straight and find all of their many records which they have found necessary in the development of scientific management for an engineering plant.

It is interesting, in this connection, to note the definition that "science is classified knowledge." The service of classification of things in driving us to make standards, as above mentioned by Mr. Thompson, is difficult indeed to overestimate. It is a little like the general point made above about the preservation of experience. We tend each time

we have a purchase to make to do the thing anew, or perhaps to do it differently. The investigation of the equipment of some large institutions sometimes brings some ludicrous facts to light, such as a government bureau in Washington using sixty-six kinds of pens, a great university buying twenty or thirty grades of paper through ten or fifteen different men, from half a dozen different stationers. This knowledge promptly results in the establishment of a purchasing department and standards.

Development of classifications gives knowledge of materials in hand, the finished parts in hand, and, above all, it gives results through the satisfactory filing of records and correspondence for future reference. As an example of this, an American college recently took to filing in the library copies of specifications of buildings and instructions connected with them. In a short time there was accumulated enough material to quite confuse the librarian, and therefore a special classification became necessary. This material covered nearly all the ordinary kinds of buildings, and soon gave the management much collected material which enabled them to speak intelligently and with experience about further work. In other words, they were getting standardized ideas in regard to building.

Cost Keeping.—Cost keeping is nothing but one of the subdivisions of the records that a plant should keep. The value of records is in their use. It is true that there are places where elaborate records are kept and are not used. Experience is worthless unless it teaches us something. Take the committee system described in the previous chapter. If members of committees are left to guess, it will not be of much effect; but suppose they have in their hands detailed, accurate, statistical reports telling about the state

of the works. Here is the item of the cost of the office of superintendent. How shall it be divided? Here is the selling system. Why is its cost so high? What did this article cost? What did this line of product cost? It is a fact that many a plant has gone to the wall from the simple fact that it did not know what its goods cost, and was pushing hardest the one on which it was losing money. I recently knew of a firm that went into the hands of the receiver from the simple fact that they were pushing a favorite article, every piece of which was made at an absolute loss. The receiver made some cost analyses, found out what to do, put up the price of the article to a profit basis, and the firm is "making good." It is true there are certain times when firms must sell certain lines below cost, and some constantly below cost, but it is highly important to know how much they are below cost and how much the profit lines are above cost.

Bring before a committee the analyzed cost sheet, and there is material for discussion from which benefits may arise. Something is likely to happen when the head of a department is asked, "Why do your goods cost so large an amount?" If improvements are within reach, this will bring them.

The tendency of cost analysis and cost study is to get standard costs for things in each particular works, just as we have standard costs for supplies, standard time for work, etc.

The Exception Principle in Handling Reports.—Making a huge number of records and reports tends to produce a flood of stuff, which, if it is all read by the responsible parties, leaves them no time for anything else. As standards tend to be developed, the proper handling of record reports

goes over to the exception principle. Shall the superintendent spend forty minutes examining a certain detailed report every day? If it is normal, no, by no means. If it is abnormal in any respect, he should by all means focus attention on the abnormal spots, which could be pointed out to him by some assistant. Thus, instead of handling the mass, he handles exceptions, just as the doctor who does not see his patient every day, but comes when the patient is disarranged.

The Value of the Graph.—Statistics are dull and deadly things, but they are capable of great illumination by the utilization of the curve. One of the best known facts in connection with the psychology of presentation is that a picture is superior to the printed page. It is the direct means, whereas the printed page is the indirect means. As the picture is to the printed page, so is the curve or graph to the column of figures. Instead of making it a subject for the slow and heavy process of examination and thought, it fixes the attention so that it catches the eye as a picture does. Not only does it do it more quickly, but it does it more accurately. Our minds are not built to note quickly the fact that 93 is about one-ninth greater than 83, but if the curve runs across the page in one place at 83 and in another at 93, it puts the relation instantly before our eye. Any one can test this out by taking two columns of figures, such as the corn yield per acre of Roumania and that of Illinois for a seven-year period:

	1904	1905	1906	1907	1908	1909	1910
Roumania	4	12	25	12.5	15	13.4	21.2
Illinois	39.8	36.1	36	31.6	35.9	40	39.2

Look at those two sets of figures on the page and then make a chart of them and you will be convinced. If you have

statistics to present to your superior, you will get them across his mental vision better in graph than you will in columns.

Production and Operation Records.—The firm that is going to deliver an order of goods at a given time must have the things produced at a given rate. Some factories have therefore developed records showing the daily balance of work for the various departments. Suppose the plant is putting out two locomotives per day. That means that the foundry will need to make eight driving-boxes per day; but the foundry is also making many other things. Perhaps it is making parts for other types of machinery. Many things are thronging to the attention of the foreman of the foundry. Many details must be looked after. Many men must be kept going. The average man tends to be content if he gets out "about enough." "About enough" might, in his mind, be seven driving-boxes rather than eight, but that means one locomotive for that day rather than two, because it takes four driving-boxes for a locomotive. Therefore "just about enough" means failure. "Just enough" means success. Here, therefore, comes the daily balance-of-work sheet showing the amount that should be done and the amount that is done. So on, all the way through the works, these departmental balance-of-work sheets may be kept. The first thing they do is to establish a task system for the particular foreman. He knows exactly what he is up against. Second: here is the superintendent who finds that he is about to "fall down" on his delivery. Here are the balance-of-work sheets. He finds that departments A and B to-day have failed to produce the desired amounts. It is like a telephone call from the battle front announcing that the enemy has charged and broken through the lines.

Reinforcements must be sent at once or the position will be turned. So the factory manager has the weak points shown up. Perhaps there is a shortage of men. Perhaps there has been bad material. Perhaps there has been bad management. Whatever it is, he knows at once where trouble is brewing and where reinforcements need to go.

If this kind of statistical record looks elaborate—and plainly it is elaborate—attention should be called to the fact that an elaborate enterprise requires elaborate controls, and the increase of returns resulting from such knowledge is beyond a doubt worth many times what it costs. Some who have tried it declare that if it cost ten times as much they would have to have it just the same. It removes indefinite uncertainty and replaces it with definite knowledge. Knowledge is power just as surely in an engine factory as in any other place, perhaps more so.

Time and Production Cards.—Some works have developed a system of keeping records somewhat as follows. A man has a card with his name and number on it. It is stamped with the hour of his arrival at the works. It contains a record of the job or jobs he does during the day, time of quitting, all with the O. K. of his foreman. Here we get the raw material of any kind of accounting that may be wanted. It contains, you will note, the man's record of time, the jobs he worked on, and the rate, so that when these cards are turned in at night the works can, by eleven o'clock or noon the next day, tell just what each man did the day before, just what time he took on each job, and what was the cost. This permits part of the afternoon to be devoted to the careful planning of the next day's work.

Use of Production Records.—These daily balance-of-work records are very valuable as history. It is more than a matter of mere interest to know that last week or last month or last year this shop with a certain number of men turned out a certain amount of product. They are particularly valuable also as men records. It is a fact that to the present time one of the greatest commodities in America, labor, is still being bought with the least inspection. How many days has this man been off in the last month? The records can easily be shown. What has he done? The records can easily be kept, so that the results are not matters of opinion, but matters of fact. Thus, if a man is worth more pay, he can get it. If he is worth less pay, he can be moved on. This enables a management to take advantage of the fact that an efficient man highly paid is much better satisfied than an inefficient man proportionally paid.

The admonition "Let there be light!" is perhaps as important in a factory as elsewhere. I recall the case of two young men who inherited a large and complex business from the father and uncle, who, as the firm, had run it successfully in the old-fashioned, hit-or-miss, going-it-blind-but-hit-the-mark method. The young men inheriting it had to do something with it. They had worked in it in lower capacities and they tried to run it. Before they knew it they were losing money at a tremendous rate. As records were inadequate, they hardly knew where they were until they had run into serious financial difficulties. Owing to the fact that the turn-over was rapid and the process of gain or loss great, they were in the hands of a trustee before they could turn themselves. The trustee assisted in the installing of cost records and production records, so that by noon of any Monday they could know more about

the financial aspects of the preceding week than in past times they had been able at the end of six months to know about the preceding year. With these searchlights they could examine the structure, they could find what was dead and cut it out, what was alive and nourish it. After thus being set upon their feet by the beneficent trustee, they are now again in charge, and, aided by adequate records, are proceeding to win back in profits the losses of the dark ages of half-recorded guesswork.

CHAPTER XXIV

Scientific Management and the Wage Problem

One of the most important parts of work is the wage. How high shall it be? What happens is that two men, the employer and the worker, work together, usually with the employer's machines, and produce some product. How shall the income of it be divided? Pending the determination of some general principles upon which we have not yet agreed, we have here the basis for a conflict, really one of the primal conflicts of the earth, settled practically by force. This must continue to be the case until we can bring in some philosophy or reasons. Then they will be in turn enforced by force.

What sets the wages? Practically it is the other opportunity. This other opportunity may be settled by natural conditions, or may be settled by artificial conditions. The really alternative opportunity is land (see chapter on "Basis of Wages," and African story in the next chapter). Since in Europe and America land has long been a private institution and the natural opportunity is therefore denied to most of us, it is necessary to bring in artificial control of labor. For example, the "Statutes of Laborers" passed centuries ago in Europe were attempts to establish minimum wage. They were, however, obsolete by the time of the Revolutionary War, which happened to coincide with the coming of the machines which made the industrial revolution. Then also came a new social philosophy as a result of the writings of Adam Smith, a Scotch philosopher.

Laissez Faire and the Labor Union.—Adam Smith's

new philosophy was an idea covered by the French words "*laissez faire*," which means "let alone." His idea was that instead of all this bothersome legislation, if we gave everybody leave to pursue his own way as best he might, the combined result of the efforts of each would make the best results for all. This idea happened to come into popularity at a time when the great political and military excitements of the French Revolution and the Napoleonic wars further called people's attention away from legislation. The result of the first forty years of *laissez faire* gives us one of the lamentable chapters of history. The entire manufacturing system of England was made over, and in the making over the manufacturers got the upper hand, and, being able to do as they pleased with wages, they put them down below the point of sustenance of the worker. The record of industrial conditions in England in 1830 is as shocking as any of the atrocities of war, with the added element that it was deliberate. The origin of the labor union, the natural turning of the worm, was the result, and in England labor unions are stronger than in any other country, and here, as elsewhere, they have, as they have acquired the power, put wages higher and higher, made hours shorter and shorter, and usually made the output less and less, following the natural teaching of human nature, which says, "Give as little as you can and get as much as you can." The fact is that neither group, employers or labor union, has shown any reason to be trusted with the power of control over the other or the public, either through the setting of wages or the deciding of the size of a day's labor.

In its organization labor has always held out for a "fair day's wage for a fair day's work." That is a good-sounding phrase, but, like a good many good-sounding phrases, it does

not bear close scrutiny. What is a fair day's wage? What is a fair day's work? Through all the centuries labor has been bought and sold, and there has been, down to the present generation, no attempt to determine what was a fair day's wage or a fair day's work. We have been peculiarly negligent of applying science to this phase of human activity. We have organized departments, government bureaus, and departments of universities working with the greatest expense and pains and accuracy upon the questions of standards for raw materials, standards of manufacture, and upon the similar questions of processes of manufacture. The question of the treatment of labor, the management of labor, and the buying and selling of labor, either from the standpoint of its own welfare or the welfare of the community, has been strangely let alone.

What is a Fair Day's Work and a Fair Day's Wage?—The credit belongs to Mr. Taylor for having been the first man, so far as we know, to go at either horn of this unsolved dilemma. He went far toward solving one part of the question. Certainly he told us how to solve the question of what is a fair day's work. By time study and motion study and experiments upon men at work, he laid down the methods whereby we can determine what, in certain kinds of work, is a fair day's work for a man to do without injury to himself if kept up for a normal working period. This is a great achievement in science. It enables his work to properly be called scientific management. In the place of guesswork and squabble and quarrel he placed a standard. He advanced the concept of standard, and to a large extent developed the methods by which an expert, a labor union representative, if need be, can by experiment

and study give a definite answer to this puzzle of the ages, "What is a fair day's work?"

He found, as a matter of fact, that with improvements in conditions of work, such as its adequate planning, the cutting out of waste motions, establishing methods of least waste, and then having a man do a fair day's work, the amount of output was, for a good man, from two- to four-fold what it had been under the conditions that he found. This was true even for such apparently simple work as unskilled labor—shovelling coal, sand, or carrying pig iron.

As to a fair day's wage, Mr. Taylor has made no contribution, although he gave the matter of wages much study and came to some very definite conclusions. He went into certain works in an industry and revolutionized the works, making it possible for men to turn out from two- to four-fold as much product, thus making an increase of income with which to pay an increase in wages. This he did; but how much did he increase them? Was it to the point of a fair day's wage? Of this point there was no such systematic determination. Here he was not a scientist, rather an opportunist, a bargainer. He made no attempt to study what was a fair wage, but he made much study of what was an efficient wage. He paid people enough to make them do the amounts of work which he found they could do.

It is interesting to note that men in works have actually struck to compel the management to install the Taylor system so that the works would be in a position to pay them higher wages.

What is a Fair Day's Wage?—The answer to this question is more difficult of determination than the one, "What is a fair day's work?" And the answer must be given in terms not of physiology and mechanics, but in physiology

and standards of living. In the latter it is essentially a sociological answer. By what means shall we determine the fair day's wage? A fair day's work is the largest that a man can do without injury to his physique or his mind or his nerves. The fair day's wage is one large enough to maintain physical vigor of the man—and what else? But, first, how shall he maintain his physical health? Shall he eat beans and rice, and meat once a week, as the working people of some nations do? And if he eats meat, shall it be a little bit of salt pork for flavoring, or shall he eat meat every day, and, if so, shall it be meat that costs ten cents a pound, twelve cents, fourteen cents? Or shall he eat meat twice a day? Shall he eat it three times a day? Shall he live in a log cabin or a tent, or a two-room apartment, or a three-room or four-room apartment?

The determination of the fair wage thus runs us at once into the question of social standards. Shall a man support a family? If so, shall he support a family consisting of a wife only, or shall he have a wife and one, two, three, four, five, or ten children? Plainly this is a complex problem in which numerous assumptions must be taken as a starting-point. Shall the children go to school? If so, shall they go to grammar school only or to high school? This will decide the length of time that they shall stay out of employment and therefore the demands that shall be made on the family income. Must the wife work out, or shall she stay home and take care of the family? Despite its complications, this is a problem at which we are going manfully. The idea of minimum wage legislation which we are now attempting in many states, and which is apparently here to stay, demands absolutely that we shall have some kind of standard of consumption to which the minimum shall

rise. Furthermore, Mr. Taylor's work as to determining what is a fair day's work should be of great social service in assisting in the determination of minimum wage. Manifestly legislation should grant the minimum wage only to the man who can do a fair day's work. Mr. Taylor has told us how to find that out, and it is fair to assume also that we can determine what is, for a given locality, a fair day's wage, enabling a careful spender to maintain a standard of decency which we shall for the time being assume to be standard. Of course, another generation will require a still different standard for a fair day's wage, although the facts of physiology are likely to leave a fair day's work fairly constant from man's standpoint, with the output increased as we make technical improvements in industry.

Mr. Taylor's Discovery in Wages.—A careful reading of Mr. Taylor's book on shop management seems to give some ground for the belief that he thought he had solved the question of wages as definitely as he had solved the question of work. What he really did do was to make a discovery in human nature.

The second and equally interesting fact upon which the possibility of coupling high wages with low labor cost rests is that first-class men are not only willing but glad to work at their maximum speed, providing they are paid from 30 to 100 per cent. more than the average of their trade.

The exact percentage by which the wages must be increased in order to make them work to their maximum is not a subject to be theorized over, settled by boards of directors sitting in solemn conclave, nor voted upon by trades unions. It is a fact inherent in human nature and has only been determined through the slow and difficult process of trial and error.

The writer has found, for example, after making many mistakes above and below the proper mark, that to get the maximum output for ordinary shop work requiring neither especial brains, very close

application, skill, nor extra hard work, such, for instance, as the more ordinary kinds of routine machine shop work, it is necessary to pay about 30 per cent. more than the average; for ordinary day labor requiring little brains or special skill, but calling for strength, severe bodily exertion, and fatigue, it is necessary to pay from 50 per cent. to 60 per cent. above the average; for work requiring especial skill or brains, coupled with close application, but without severe bodily exertion, such as the more difficult and delicate machinist's work, from 70 per cent. to 80 per cent. beyond the average; and for work requiring skill, brains, close application, strength, and severe bodily exertion, such, for instance, as that involved in running a well-run steam-hammer doing miscellaneous work, from 80 per cent. to 100 per cent. beyond the average.

There are plenty of good men ready to do their best for the above percentages of increase, but if the endeavor is made to get the right men to work at this maximum for less than the above increase, it will be found that most of them will prefer their old rate of speed with the lower pay. After trying the high-speed piece-work for a while they will, one after another, throw up their jobs and return to the old day work conditions. Men will not work at their best unless assured a good liberal increase, which must be permanent.

It is the writer's judgment, on the other hand, that for their own good it is as important that workmen should not be very much overpaid, as it is that they should not be underpaid. If overpaid, many will work irregularly and tend to become more or less shiftless, extravagant, and dissipated. It does not do for most men to get rich too fast. The writer's observation, however, would lead him to the conclusion that most men tend to become more instead of less thrifty when they receive the proper increase for an extra hard day's work, as, for example, the percentages of increase referred to above. They live rather better, begin to save money, become more sober, and work more steadily. And this certainly forms one of the strongest reasons for advocating this type of management.*

Notice that this states the fact that men will work their best for certain increases over the average wage of their trade. But what is this average? What sets this average? Plainly Mr. Taylor's discovery is no panacea for society,

*"Shop Management," F. W. Taylor, Paper No. 1003, American Society of Mechanical Engineers.

although, beyond a doubt, it was for Mr. Taylor. He was exactly in the position of one who had patented a machine, or like Mr. Ford, who has temporarily perfected an organization for the production of a large income which he can divide in any way he sees fit. Mr. Taylor, by enabling men to produce two or three or four times as much as they are in the habit of doing, could divide some of the increase with them just as any patentee or holder of temporary monopoly can. He was dividing a melon, not announcing a panacea. Notice that he refers to the average of the trade. But what is this average? Plainly if men will work their best for 30 to 100 per cent. more than the average, it is true in China, where the average is 30 cents a day; also in the Klondike, where at times the average has been $10 a day. The average is left alone, and, furthermore, how is Mr. Taylor going to get the second generation their 30 to 100 per cent. increase, for he says an *increase* is necessary? He made the first increase because he established scientific management and made the 200 to 400 per cent. increase in output. But this has been done, and it cannot be expected again. The second generation of men come along. How is he going to give them 30 to 100 per cent. increase over and above the average?

Mr. Mitchell and Mr. Taylor.—The story is told that a certain very wealthy lady in New York, who was fond of having interesting discussions at her dinner table, succeeded, after much effort, in getting together a small group of rather distinguished persons, including Mr. Taylor, who sat at one side of the hostess, and Mr. John Mitchell, who sat at the other side of the hostess. The purpose of the whole thing was to get a discussion on scientific management between these two men. At the proper time the hostess

threw the conversation into this subject and got Mr. Taylor in brief to tell what scientific management is, and then she asked Mr. Mitchell what he thought of it. His reply was short, and it ended the conversation. He said, "Oh, it is just another means of getting a workman on the stretch and then keeping him there at a low wage."

The economists, I believe, are more nearly with Mr. Mitchell than with Mr. Taylor. Mr. Taylor's temporary success (though it lasted out his lifetime), in having no trouble with labor unions, was due to the fact that he was still working in the corner of a single trade. He had never got to a second generation or to the time when a whole trade had been put under scientific management and real competition had again developed. The idea of paying men varying wages in proportion to their varying powers to produce is, beyond a doubt, good, but these variations depend upon the base rate. What is that? It is simple to see that the Taylorized shop twenty years hence will with good cause say to the management, "We want a 10 per cent. increase." How will they get it? Human nature is not in the habit of handing out money before it is asked. Furthermore, it is not in the habit of handing it out when it is asked, unless there is reason why it must do so. Can any person familiar with labor conditions see any reason why the works should do so, except the good old primal reason of the prospect of a strike? Scientific management has not abolished labor unions. On the other hand, it is probably true that the labor unions are doing very unwisely to fight it. They should accept it and use it.

The Same Service as a Machine.—Looked at in its broad analysis, in its general relation to the community, the service of scientific management is identical to that of a new and

improved machine which turns out twice or three or four times as much as an old machine. If we stop and think about it, we see it merely makes men and machines turn out more goods. It leaves entirely alone the question of the distribution of the goods, and there are good reasons why the pessimist might say that we do not need it anyhow. At the present moment we have increased our powers of production so tremendously that one of the greatest problems that faces industry is the question of employment. Factories stand idle with machines capable of great production; men capable of making these machines produce also stand idle because markets cannot be found. "Perhaps," says the pessimist, "we do not need any more scientific management because we can't use the equipment we have." The pessimist on this ground could make a good fight, speaking as the public. As a private business man he is driven by the forces of competition, where they still work, to use every machine which he can use in his business to increase his output and his private income. That is what we are doing with scientific management, which is here to stay, but which is not going to solve the wage question. It will, however, give us greatly-increased production, as have other machines, and therefore the possibility of greater wealth and the possibility of increased wage. The trouble with this old and true doctrine of the economists, however, is that it works so slowly. It is easy to sit down with the economist in his closet and say that the doubled capacity of all machines to turn out something will make wages higher, but it takes the concrete increase of wages a long while to come.

An Attempt to Solve It.—The really great problem facing the world to-day is distribution and not production. We have in the past had no more definite ideas on this point

than have existed as to what is a fair day's work and what is a fair day's wage, but some developments of the wage situation in the English cotton industry are exceedingly suggestive. They point to the development of standard returns. How much return should money get? We have a rough agreement in most parts of the United States that 6 per cent. and your money back is enough, provided the money will come back. If you can be absolutely sure it will come back, as in the case of government bonds, you should take less. The experience of the market shows it. Therefore if a group of men work as laborers and others as owners of land, is it fair for the owner to get 20, 30, or 40 per cent. return on his money? Thus far we have raised little objection to it. Witness several of the companies participating in the anthracite coal industry of Pennsylvania, where dividends of 30 per cent. rising out of monopoly control are a regular occurrence. But in the competitive English cotton industry this is impossible because of the prompt entrance of competitors into any such gold field if the gate is open. This cotton industry is old established. The labor union goes back to about 1835, and its experience, because of long period of time and consequent ripe development, is exceedingly suggestive. They have an agreement between scores of thousands of workers with a large association of manufacturers that the rate shall be so and so. But when times get dull and the income of the well-managed plant falls off, the producers' association goes to the workers' association and demands a concession of 5 or 10 per cent. They get it. Conversely the orders boom, dividends rise, workers come back not only for normal wage but for an increase of 5 to 10 per cent., and they get it. This approaches a settlement of the distribution problem. Recent

American developments, for example in the clothing trades of New York, are moving rapidly along in that direction. By recent agreements we have already reached the point where the employers are prevented from breaking up unions by discharging individuals. The employer's freedom to discharge men is eliminated by giving the discharged employee the right to appeal to a board of equity action which appoints a board of employees and employers with an impartial chairman, having the authority to decide whether or not there has been reasonable cause for discharging the individual. It practically amounts to establishing a civil service in the industry, which gives a security for employee and a continuity of labor, and is really an exceedingly suggestive occurrence. Such an intrenchment of the union is a great preliminary for a real discussion of wages and distribution. Standards must come into this as surely as into the purchasing department or the manufacturing department.

CHAPTER XXV

INDUSTRIAL MANAGEMENT OUTSIDE THE WORKS

UP to this point this book has dealt very largely with the problems of production that are usually to be solved within the works, that are specifically a part of the enterprise and are usually regarded as private questions, although many of them, of course, have a public bearing. But, after all, the management of many an industry barely gets along because of the influence of things over which it has little control at the present time, but which, because of their biting influence, challenge us to rise up and control them. Everywhere, as I talked with business men during the months preceding and succeeding January 1, 1915, I heard the same lament, "Business is dull. We can't sell goods, therefore we can't make goods." We have in our midst the final lunacy of the ages—an industrial depression—unused resources, piles of raw material lying inert, rows of fully-equipped factories with their machines standing silent and idle, thousands of men and women hungry, poor, half naked, clamoring merely for the chance to work and at rates which careful investigation (see *Annals of the American Academy*, May 15, 1915, vol. lix, p. 111) have shown to be inadequate to the needs of an American citizen.

Scientific management shows us easy ways of increasing our production 300 or 400 per cent., yet the fact remains that we are not fully utilizing our present equipment at the low efficiency we at present tolerate. For example, a study of the official figures for the state of New Jersey in the year 1912 shows that there was in that year virtually

25 per cent. of unemployment (see *Annals of the American Academy*, May 15, 1915, vol. lix, p. 125).

It seems quite plain that the real problem facing the managers of American industry is not, after all, time study or the increase of scientific management, but something which will enable us to do business. If we could just, by some miracle, untangle our centipede legs and get a-going, it is plain there would be three or four times as much stuff to use, which ought to mean three or four times as much real wages. The problem then is really one which the economists call distribution, not the making of things, but the getting of them passed around to the human race after they are made.

The Problem and the Problem Round.—The truth of the matter is that our suddenly-created world industry with our habit of making for distant markets, has given us a host of problems which are as big as our market and our industries. We are too prone to see the captain of industry stand up, boast about figures of productions, national wealth, bank clearances, and such other industrial data, when he is entirely ignorant of the fact that along with these things come problems as big and even more perplexing. We have spent a century along the idea of *laissez faire;* namely, giving every man all the liberty possible so that the total result of the efforts of each will be best for all. We find it does not work. We have a problem round somewhat as follows. Some one makes a discovery in science which is of no apparent value. A little later on some student of applied science turns it into a useful invention which results in a short time in a machine. The individual seizes upon this machine, puts it into his business, and doubles his output. The first and immediate result is

that the old hand-worker is thrown out of a job. His family is wrecked. A call goes to the charities society to come to the rescue. A little later on, after a number of people have begun to make their fortunes out of the new improvement, we realize it has given us a serious social problem. For example, at the end of eighty years of tinkering with the railroad we have just discovered that the railroad is not at all a private matter, that we can't let the railroad man decide the rates to suit himself, that the railroad is public matter subject to public control, and the public has begun to control it. But please note that the railroad was first invented in 1829, that the Interstate Commerce Commission was created in 1887, fifty-eight years later, and that the commission never had any power to regulate railroads to any material extent until the railroad had been in business for about fourscore years. Meanwhile it had concentrated the industries of the continent at competitive points, piled up people in millions in great metropolitan cities, absolutely changed the face of the nation, giving us some of the greatest social and economic problems that the race has ever faced. Out of it we have had the slum and the coal trust, and the type of fortune represented by one of our citizens who gets an income of $6666.67 an hour for every hour of the ten-hour working day of the business year. He gets this income, by the way, without doing anything, merely because he was a skilful monopolizer of natural resources.

Typical of the industrial problem which faces us as citizens and which faces us as business men, and perhaps the most biting of them all, is the above-mentioned industrial depression, which is to commerce and industry what paralysis is to the human body. No wonder we are in the midst

of a host of persons who are clamoring for reform! No wonder some of them even so placed as is Mr. Guggenheim, of the Smelting Trust, should declare that only the government could solve it! His words follow:

Chiefly because of the advancing cost of living, but largely, at the same time, on account of the ever-growing inequality in the division of the wealth of the nation, there has been for many years a steady increase of discontent among the laboring people of the United States. This discontent is bound to keep on growing unless radical steps are taken to alleviate the present condition of the laboring classes. A great many things have been done during the past few years to benefit the laboring man, but more must be done, and more will be done, because employers of labor and managers of business are commencing to realize to a greater extent than ever before the nature of their obligations toward their toiling employees.

Whatever may be the temporary expedients adopted to tide over present difficulties with which the laboring population is confronted, the ultimate solution of the entire labor problem must come through governmental action after careful and non-partisan scientific study.

Unemployment, sickness, old age, and similar problems of labor can be solved only through some system of social insurance managed and applied by state authority. If a man is out of employment, it is the duty of the state through some agency to help him obtain work. If a man is physically unfit for labor either on account of injuries, sickness, or age, provision should be made by the state for his care.

Our industrial organization must be democratized. It must be transferred so that the laborer himself may have a voice in the determination of all the conditions by which his interests are affected, the length of his working hours, the amount of his wages, and the surroundings amid which he labors.

As indicated before, the attainment of industrial democracy must come in the main through scientific legislation. Through the action of the federal and state governments, employers and laborers must be brought together by a system of laws in the making of which all members of each class shall have an opportunity to participate. A great deal has been done in the way of legislation in this country, but we are still years behind many foreign countries in providing for the welfare of workmen. Although many people are of the opinion that too much legislation is being enacted, I do not agree with that idea, nor do I think that we have begun to legislate to the extent that we

shall in the future for the welfare of the workmen. I think the difference between the rich man and the poor man is very much too great, and it is only by taking steps to bridge the gulf that exists between them that we shall be able to get away from the unrest now prevailing among the working classes.*

Some of the Ways Out.—There are some people who think that American industry can never be straightened out until there is a different control of credit. Even at the present time the complaint is made in some parts of the country that credit can only be obtained by producers by paying 40 per cent., and they cannot always get it at that. Credit is in the hands of *bankers.*

The Socialist is sure that the whole basis of conduct of our industry is wrong. He says that if the right to work can only be realized by the government taking entire control of industry the government will take that step. I think he is right in that statement. He further points out that production is not organized primarily for the purpose of supplying needs, but for the purpose of extending profit to investors. He would have industry run to *supply needs* and thereby make a great change that would bring the industrial millennium. As to how this reorganization from profit basis to service basis is to be made, the Socialist propaganda is usually as bare of method as are the minutes of that famous mouse meeting where they resolved to bell the cat. But the really important point is that the collectivist does not have to furnish the method. It has been done for him. The world's greatest promoter of socialism died the other day in Philadelphia, leaving the method behind him. Frederick W. Taylor, the world-famed exponent of scientific management, has done more for socialism than Karl Marx

* *Annals of the American Academy,* May 15, 1915, vol. lix, pp. 209–10.

or any school of theorists. The theorists merely painted a wish. Mr. Taylor, who was anything but a Socialist, showed them how to get it. He projected into men's affairs with great emphasis and convincing evidence the idea of standards. Last fall, at the Mayors' Conference in Philadelphia, the quarrel between the champions of public ownership and of private ownership of municipal enterprises centred upon the point of efficiency. Here is where Mr. Taylor contributed. Ten years ago the critic used to tell the man on the inside that he was inefficient. The man inside would say, "You're a liar!" The man outside would say, "You're another!" They might perhaps have a fight, but the subject of the controversy was illumined by no display of facts. There were none worth mentioning, only *opinions*. Since the standardization idea has come, the critic announces that the electric company is inefficient *because* it uses one-half pound more coal per horse-power hour than the standards of good engineering practice permit. Since this is a matter of record, all the electric company can do is to squirm and try to show good reason why it should be different from the standard. The significance of this change is difficult to appreciate.

Granted a half-way decent desire for efficiency in works management, it is within reach as never before, and the Socialist propaganda, already rich in grievances, is now enriched by the greatest tool ever placed in its hand for achievement.

Just as an illustration of the Socialists' point about an industrial life dependent on enterprises run for service rather than for profit, I call attention to the railroad situation. I do not know what causes depressions, but I do know that they are characterized by an almost complete

cessation of the making of equipment. Prosperity consists of a heavy period of equipment, when many producers enlarge their capacity. We have no normal condition. Now suppose the United States Government owned all the railroads and that the whole weight of government was thrown into the problem of keeping industry going smoothly. All government equipping would be rushed in dull times and starved as far as possible in rush times. Certainly this would be a great steadier, but cannot we obtain it by other means? If not—I merely call attention to the Socialist vote in the United States and Frederick W. Taylor's contribution—*standards.* I think that we have here a new call to public duty on the part of those who have power, certainly on the part of those who do not wish to see a rapid increase in government operation of industry.

The Land Monopoly Tax Group.—The bitterest enemy the Socialist has is the land taxer. Instead of permitting the monopoly of natural resources which our present land system permits, this group of reformers would avoid restriction of output by making the tax on land so high that no man could hold it except he used it. That at once would break up all monopoly of raw material and give a chance to everybody who wanted to get land for a small annual payment. The way the thing works is admirably portrayed in a recent story from Africa.

The Labor Commission of this East African Protectorate has undertaken to find not how labor can get jobs, but how employers can get labor. The commission has taken testimony of the more important of the 3,200 European inhabitants, and has found a most remarkable agreement in the minds of white men. Lord Delamere, owner of 150,000 acres, said:

"If the policy was to be continued that every native was to be a landholder of a sufficient area on which to establish himself, then the

question of obtaining a satisfactory labor supply would never be settled. He considered the soundest policy would be to curtail the Reserves. And, although it might take a few years before the effect on the labor supply was apparent, the results would be permanent."

This was the gist of the testimony given before the commission by the white men who complained that they could get no labor. The Reserves mentioned correspond to our Indian Reservations, and embrace the lands upon which the 4,000,000 natives reside under tribal conditions. Upon these lands they are able to make a living now, as they were before the white men came to their country, and, being able thus to support themselves by a little labor on their own land, they decline to work for the white man on his land.

. . . .

Some of the white land owners declared themselves in favor of forcing the natives to come out of their Reserves and work for them. But this would amount to slavery; and slavery, as every one knows, would not do in this day and age. The wiser men asked merely that the Reserves be closed, or restricted, or that their location be changed to poorer lands; they asked, in a word, that conditions be made so uncomfortable for the natives in their free conditions that they will willingly work upon the lands of the white men. Among the reasons given by the commission for the shortage of labor was:

The wealth of certain tribes arising from the large quantity of land at their disposal.

And the Commissioners add:

It is clearly recognized that there are practically no natives who need to work for wages in order to live.

. . . .

Here is the essence of the labor problem, the world over. Everywhere man is a land animal. Where he has access to his native element he is independent. Where he is arbitrarily shut out from his element he must make terms with those who shut him out. Has not this a lesson for our own labor people? If the free tribal lands in Africa make the negroes independent, would not free land in this country do the same for all men? Unions, closed shops, minimum wage laws, an eight-hour day, and various other arbitrary enactments may protect labor a little; but it will be free and will enjoy its natural rights only when it has free land to go upon. Out of Darkest Africa comes light.*

* *The Public*, June 11, 1915.

War and Peace.—The world-paralysis that war produces is ten times greater in this day of world-commerce than ever before. When we consider its destruction of business, its destruction of capital, to say nothing of its destruction of life, serious work looking toward its elimination may well be considered a part of the normal and proper work of the management of any established business.

The Machine Smashers.—One of the most difficult things with which industrial and social progress has to deal is the machine smashers. They are known in industrial history as the Luddite rioters because of certain riots that occurred in England on the introduction of factory machines which so rapidly replaced the hand loom and the hand spinning. The old spinners who found their output suddenly so reduced in price and in quantity that they could no longer compete sought to restore the good old days by turning out in the night and burning the mills and smashing the new machinery. Perhaps the occasional student of industrial history is inclined to think that these Luddite rioters were a temporary and a past phenomenon! If, however, a broad definition is given to their action, it will be seen that they are strangely persistent. As a matter of fact, there is still some continuance of actual machine smashing in various parts of the world as new machines are introduced. I saw it myself in the case of the self-binding reaper in Virginia, in 1885. The men have been proved right, from their viewpoint, too, for harvest wages went down with the coming of the machine. The skilled and highly-paid craft of hand wheat cutters is gone. Many allied actions producing identical social results are still going on and even bear the stamp of respectability. Defined in social terms, the Luddite rioter is one who inflicts a large loss on

the community by reducing its possible product so that he may have a small personal gain through the continuance of inefficient methods. This action yet persists in many forms. We see it in a trade union that limits the output so that the workers may have higher wage because the community has less goods. Identical with this are the combinations that exist from time to time among groups of manufacturers who restrict output in order that they may have an advantage identical with that of the labor union when it restricts output.

Another very common case is the smothering of patents. It is rather a common practice in American manufacturing for some large producer to buy a patent outright and then put it in his safe and not use it, for the reason that in its disuse he is in a satisfactory position to continue to compete with his rivals, whereas if the rival had the patent all producers would have to introduce it also and thereby break up many patterns, perhaps sacrifice many manufactured parts, and make a new type of machine at the same time that he kept alive the production of similar parts for the machines that are already in the field and occasionally need repair. Thus he takes the greater profit from the old type and cheats the community out of the new type of machine.

In one of the counties of Pennsylvania which has not a mile of railroad in it there is a tunnel a mile long. In the Susquehanna River at Harrisburg there stands a row of piers with no bridge. A railroad was being built from the east and west, when a rival railroad bought it up and stopped work upon it, thinking it more profitable to buy the road and put it out of business than to compete with it. Yet it is true that there are frequently times when freight traffic upon American railroads, including the one in question, is

greatly congested because of the insufficiency of facilities in traffic. In some of our eastern states the trolley lines that go through the country will suddenly leave the roadside, make a detour through the fields, and later return to the road. Why is this? It happens because the influence of existing transportation corporations in the State legislature is so strong that no trolley company can secure the power of eminent domain which would enable it, by compulsory purchase, to get the necessary land to go in the direct line. Thus the trolley companies are often kept from building lines or are made to build inefficient lines so that other transportation interests may miss the spur of their competition and the community lose their service.

Vast amounts of the waste which we are coming to recognize in American economic life are due to cumbersome, antiquated, and needlessly roundabout ways of doing business. But any reform or simplification means that some persons or groups of persons are eliminated, a process to which they object, although by so doing they make themselves the exact counterparts of the ancient Luddites, except that instead of smashing machines they smash efforts to improve organization. Thus it is often stated without much disproof that about 35 cents of the city consumer's dollar gets back to the farmer, the other 65 cents having been spent for transit services that in no way increase the value of the food. There is undoubtedly vast service to be rendered in the elimination of national waste. The cost of living would be reduced and the profits of agriculture would be increased by establishing more direct communication between farm producer and town consumer. The efforts and success of city commission merchants and other middlemen

to combat, sidetrack, and render such efforts fruitless are interesting and would at times be amusing were not the results so serious. As a matter of fact, the ancient Luddite was merely expressing in his way one of the temptations to which human nature exposes us and which unfortunately promises perennial forms of reappearance in any evolving society. It is one of the permanent factors with which we will have to deal.

A New Style.—The American business man has been brought up in the atmosphere of individualism and *laissez faire* which, with its liberty, has characterized Anglo-Saxon peoples. He has been prone to think of his business as a purely personal matter, and its public relations were everybody's business and therefore nobody's business. When he, as a "practical" man, was busy making money, the matter of reforms might do for philanthropists, professors, and idealists, but he was a "practical" man. I wish, however, to emphasize the lamentable failure that exists when a nation of practical men finds itself in industrial paralysis. We may all conduct our business individually as economically and carefully as we please, but still we have industrial paralysis which cuts us out of unthinkable profits and comfort. At the same time it produces an amount of discontent which may be responsible for some of the serious troubles which some persons foresee as they look into the industrial future. I therefore submit to such of the younger generation of American business men who may take the time to read this book that one of the great factors in the success of any business is anything which tends to increase stability and put out of the way the industrial depression. This means study of economic questions by the business man—the really practical business man.

Great things could be done if the five thousand men who dominate the industries of the United States should conclude that they were going to work for industrial stability as earnestly as many thousands of people in the United States are now working for their hobbies, such as the group that runs the Society for the Prevention of Cruelty to Animals, the group that runs the Society for Organizing Charity, another group that runs a fraternal lodge, and another group that runs a chamber of commerce or a board of trade. These are all enterprises that do not pay. They are none the less the results of work, and, while they do not pay in cash, they pay in some sense of reward, and, after all, what is cash?

As an example of huge expenditure to reward such a hobby, I will call attention to the Pennsylvania Railroad Terminal on Manhattan Island. It is generally understood that this was the pet ambition of President Cassatt. Plainly he never got any justification for it by examining its financial aspects. What he did was to put $108,000,000 down in the middle of Manhattan Island, making a huge pile which is severely criticised by architects as being a very inefficient station, although a very beautiful copy of a Roman bath. It does not connect with the subway, it does not connect with the elevated, it does not connect with any other station. In fact, it is a kind of island in a sea of houses, while at the same time the railroad had connections in the lower end of New York, through the McAdoo tubes, with the subway and nearly all the elevated roads on the island. Consequently the financial aspect of the station is as follows: it produces practically no increase of traffic, and any income that it earns is less than its operating expenses, leaving nothing. Besides this, the interest, depreciation,

and taxes lie as hopeless charges against the people who put money into the railroad, perhaps seven or eight million dollars per year out of the railroad income, in addition to the putting down of the $108,000,000 of capital. This was a hobby. The company has never been seriously called to account for it by public opinion. The point I make is that if President Cassatt had had the hobby of making stable American industry so far as his power and leadership went, and had spent that much to do it, he might have been hailed as one of the great prophets of American industrial progress.

Certainly this problem is one demanding the most serious attention of all the thoughtful persons in the United States, and it is perhaps an illustration of the fact that a large proportion of the attention that leaders of industry must be giving to industry needs to be given to things outside their own business enterprises, this, too, when profits only are in view. This, after all, has the plainest kind of defence because of the corresponding interrelations of business.

But above profits comes service. A fortune is nothing in comparison to the benefiting of mankind. The heroes of history have rarely been rich. The stableizing of industry is needed more than any number of big fortunes. May this and other social problems seize the imagination of men of power, and let them learn to say with Henry M. Stanley:

"No honor, no reward, however great, can be equal to the subtle satisfaction that a man feels when he can point to his work and say, 'The task I promised to perform with all loyalty and honesty to the utmost of my ability is finished.'"

INDEX

Accounting,
industrial control by, 44
Administration,
controlling working force, 211–228
Advertising,
in large-scale production, 94
Agriculture,
factor of "dumping" in, 64, 65
farm costs, examples of, 64, 68
failure of city men's farms, 66
free land, 1
difficulty of inspection, 96–97
importance of fairs in Europe, 13
location of implement industry, 101
relation to industry in 18th century, 14–15, 20
slowness of turn-over, 45
standardized machinery, 87
see farm
Apprentices,
in Baldwin Locomotive Works, 30
in eighteenth century, 14, 33
Arkwright, Richard,
inventor, 15
Assembling industry, 101
finished products as raw material, 102
Automobile, 84, 86, 127

Baldwin Locomotive Works, 22–36, 82, 109, 112
Barth, Karl,
efficiency engineer, 232
Blackford, Dr. Katharine,
book, "The Man and the Job," 150
Bricklaying,
motion study in, 174–175, 182
Bridges,
standardization in, 79
Business,
see production unit
By-products,
influence on costs, 70–76

Canning,
location of industry, 100
Capital,
consisted of land in 18th century, 17
large quantities needed in factory system, 21
mobility of, 99
relation to out-put, 91
required in steel business, 95
under-capitalization, 50
over-capitalization, 50
Capitalist,
origin of, 17
Carnegie, Andrew,
basis of fortune, 8, 145
Carpenter, C. E.,
committee system, 237–240
Cassatt, A. J., 28, 280
Chamberlain, Joseph,
in tariff campaign, 68
Child labor, 18–19, 137
Church, Hamilton,
on group spirit, 163–164
City,
the indefinitely planned, 121
location of factories, 101
necessary size of a, 114–115
Classification,
systems of, 245
Cold storage plant, 58
Commerce,
effect of inventions on, 14
effects of war and peace, 276
importance of agricultural fairs in Europe, 13
Committee,
as a discoverer of men, 240
general factory, 238
general foremen's, 239

Committee,
system of management, 237
Competition,
improves standards, 87
Continuation schools, 158
Cooke, Morris L.
discusses standardization, 77, 88
Corporations, 37–55
compared with partnership, 23–24
ease of starting, 37
examples of successes, 53–55
failure, causes of, 40, 42–52
functional development of, 5
liability in, 36, 37
management of, 37–38
organization of, 26
powers of, stated, 39–40
rise of, 22
tendency to graft, 52
Correlation,
definition of, 3
highest degree in a ship, 3
lack of, in American industry, 2
Cost keeping,
cost-clerks, 219
defined, 249–250
industrial control by, 6
Costs,
examples of operation, 67
influence of by-products on, 67
specialization on, 82–83
standardization, 87
of blast furnace, 59–60
milk production, 70
newspapers, 70
oil refining, 58
orchards, 75
a plant, 108
railroads, 73–74
shoes, 78
primary, 68, 74–75
secondary or overhead, 68, 74–75
Country,
location of factories, 112
Credit system,
defects in, 272

Day work, 194
determination of fair day's work, 258–259
Depreciation,
neglect of fund for, 46
Depressions, industrial, 268
utilized for re-equipping, 274
Designing,
in engine manufacture, 81–82
results of standardization in, 88
Diemer, Hugo,
book on "Factory Organization," 130
Differential rate, 194, 209
Discharging,
of labor, 161, 266
Discipline,
necessity for, 161
methods of, 162
the factory disciplinarian, 214
Distribution,
problem of, 265–266, 269
Dividends,
from corporations, 26
from depreciation fund, 45
in Garden City, 122
in English cotton industry, 266–267
"Dumping,"
a market factor, 64
a profit factor, 70–76
examples of, 67
hurts English markets, 68
influence on international trade, 63
problem in, 76

Economics,
the underlying force in history, 12
Economy,
in large-scale production, 56–61
in motion, 174–175
Education,
continuation schools, 158
object of, 142–143
sandwich system, 142
Efficiency,
and psychology, 150
reorganizing for, 229–242
Taylor and Emerson systems compared, 236
Taylor's four rules, 212
Twelve principles of, 235
Efficiency engineers, 229–239

Electric smelting,
  influence of power in, 108
Electrical specialties, 101
Eminent domain, 37, 277
Employers,
  attitude of, toward functional foremanship, 216
  need legislative control, 18–19
  tendency to cut piece-work rates, 196–197
Employment,
  discharging in, 161, 266
  discipline in, 162–168
  irregularity of causes vagabondage, 20
  qualifications of a worker, 140–165
  methods of testing workman's qualifications, 150–151
  workmen and their surroundings, 178–189
  see hiring
Engines,
  standardization in, 81
England,
  industrial supremacy of, 15–16
  industrial revolution, 15–16
  standardization in ship-building, 83
  suffers from "dumping," 68
  wages in cotton industry, 265–266
Enterprise, *see* production unit
Entrepreneur,
  fundamental type of business, 22
Equipment,
  advantages of large-scale, 56–61, 92
  a ship most highly correlated, 3
  in times of prosperity, 274
  standardization in tools, 167, 182
  owned by capitalist in factory system, 17
  relation to overhead charge, 62
Esprit de corps,
  defined, 163
  development of, 164

Factory,
  authority in, 211–228
Factory,
  location of, 111–113
  military, 211
  model, 124–130
  origin of, 14
Factory legislation,
  in eighteenth century, 12, 20
  present tendency, 12, 19, 135
Factory system,
  demands much capital, 22
  relation to unemployment, 257, 267
  rise of, 12–14
Factory town,
  model, 114–123
Farms,
  failure of the city man's, 66
  in Garden City, 122
  maintenance costs, 63–64, 67
  milk production, costs of, 70–71
  orchards, costs of, 75
Fatigue, 132, 175
Finance,
  effect of inventions on, 15
Fining,
  in employment, 162
Ford Automobile Co.,
  on assembling industry, 128
  standardization in, 84, 86
  wages, 263
Foremen,
  attitude toward efficiency engineer, 231
  conference of, Baldwin's, 27–30
  duties of, 212
  effect of too much authority on, 241
  general committee of, 239
  in task work and bonus system, 207
  the functional, 214
Foundry, 127
Freight,
  congestion of, 278
  opportunities to increase business, 93
  rates locate industry, 105–106
Furnace blast,
  costs of, 59–60

Gantt, F. H.,
  efficiency engineer, 205–206

Garden City, England, 122–129
Gilbreth, Frank,
  on motion study, 168–177
Government,
  control of industry, 271–273
  relation to the labor problem, 271
Guggenheim, Daniel
  on labor problem, 271

Habit,
  and standard equipment, 182
  in work, 132, 175
  limit of repetition, 133
Hamburg-American S. S. Co.,
  powers of, in U. S., 39
Emerson, Harrington,
  efficiency engineer, 234–236
Howard, Ebenezer,
  town planner, 114
Hiring,
  of labor, 153–154
    machinery, 64
  specialization in, 145
  see employment

Income,
  division of, 256
Industrialrevolution, 14–15, 274–275
Industry,
  an assembling industry, 101, 127
  control of, by legislation in 18th century, 12–13
  division of labor, 27, 93, 211, 215
  domestic system of, 13
  factory system of, 14–18
  government control of, 291
  "industrial revolution," 14–15, 279–281
  location of, 98–110
  Luddite rioters, 276–277
  silk-making, a "parasitic," 106
  stability of, 280
  the basis of history, 12
Inspection, 219
  influence on size of enterprise, 96–97
  necessity of in installing efficiency devices, 232
Instruction cards, 218–221
Interchangeable parts, 86
  influence or quality, 87
Interstate Commerce Commission, 270
Inventions,
  caused "industrial revolution," 12–13
  development of, 4–5
  lack of proper use, 2
  output of men and women compared, 134
  readjustment due to, 270
  result of initiative, 133
  smothering of patents, 88
Investments,
  during domestic system, 14
  during factory system, 14
Iron industry,
  location of, 102, 104

Johnson, Alba,
  discusses partnership, 22–34

Labor,
  abundance in cities, 102
  as divided by sex and age, 134–135
    by skill, 138–139
  child, 18, 19, 137
  commission in South Africa, 274
  conditions of the poor in 19th century, 19–20
  efficiency in labor through standardization, 166–177
  industrial revolution, 14–15
  legislation, 18–19
  locates industries, 98–110
  purchase of, 146
  quality of, 130–144
  relation to output, 96
  standardization, effect on worker, 89
  Statutes of Laborers, 256
  unions, 5–7, 256–257, 263
  workmen and their surroundings, 178–189
Labor union and *laissez faire*, 256–257
  control of wages, 277
  equity board in discharging of employers, 267
  in English cotton industry, 266–267
  rise of, 18–19

Labor union and *laissez faire*,
and scientific management, 263
Laissez faire, 256–257, 269, 279
Land,
cost factor in locating industry, 109–110
18th century investment, 14
land tax group, 273
relation of, to wages, 256
Liability,
in corporation, 37
in partnership, 22, 24, 37
Location,
advantage of city, country and suburban, 111–113
of an enterprise, 43, 99–110
influenced by an early start, 90
relocation of a plant, 108
Luddite rioters, 276–277
Lumbering,
location of, 99, 108
making of wood pulp, 108

Machine tool industry, 103–104
Machinery,
interchangeable parts, 87
Maintenance,
of farm equipment, 64–65
necessity of provision for, 45
Management,
definition of efficient, 9
importance of judgment in, 46–47
industrial, outside the works, 268–281
installing scientific, 229–242
military system of, 211
of the working force, 211–224
science *vs.* genius, 8
service to a community of scientific, 264
Manufacturers,
and *laissez faire*, 257
association of in English cotton industry, 265
opinion of Garden City, 123
early domination in England, 14
Manufacturing,
elements which locate, 99–113
standardization and specialization, 77–90
supremacy of corporation in, 22
Market,
importance of agricultural fair, 13
influence of specialization on, 86
locating factor in industry, 99, 102–103
relation of "dumping" to, 64
world market, 266
Material, raw,
determines construction of factory, 124
in assembling industries, 101
locating factor in industry, 99–100
monopoly of, 272
utilization of, 83
Meat-packing,
location of industry, 100–101
type of factory, 124
Mechanic,
of intermediate skill, 140
scarcity of skilled, 142
Milk production,
costs of, 70–71
Mining,
supremacy of corporation in, 22
Mitchell, John,
on scientific management, 263
Motion,
necessity of, 174
two types of, 175
waste in, 256
Motion study, 170–174
variables in, 170, 174
Moulding,
of an engine wheel, 81
Municipal enterprises, 273
Münsterberg, Hugo,
psychology and efficiency, 150

Nepotism, 51
Newspaper,
production costs, 74

Oil refining,
costs of, 71
type of plant, 126
Operation,
advantages of continuous, 84
economy of large-scale, 59–60
example in costs of, 65
records in, 252

Orchards,
costs of, 75–76
Orders,
necessity of definiteness, 213–214, 226
Organization,
basis of fortune, 5
difficulty of correlation, 4
functional development of, 4
in the business unit, 1–9
intangibility of, 5
in an army, 7
in a store, 8
in steel industry, 7
in selling, 9
lack of, in mercantile business, 6
necessity for discipline in, 161
of authority, 211
reorganization, 229–243
three types of business, 22–36
unit of in domestic system; in factory system, 20
Overhead charge,
definition of, 62–69, 96
effect on costs, 70–76
in specialization, 84
in Garden City, 123

Patents,
output by sexes compared, 134
smothering of, 72, 233
Pattern-making,
in engine manufacture, 66–68
Partnership, 18–30
Baldwin Locomotive Works, 22–36
disadvantages of, 25–26
liability in, 23
permanency of control, 23
weakness of, 32
Philanthropy,
confused with business, 44
misuse of term in business, 129–130
Piece-work, 194–195, 209–210
rate cutting, proper and improper, 196–197
Planing mill,
location of, 103
Planning,
department of, 216–217, 219–220, 224
factory, 124–130
Planning,
town, 110–123
Plant, 125–126
cold storage, 58
cost of, 129
types of, 124–130
Power,
locating factor in industry, 100, 108
Production,
advantages of large-scale, 57–61, 94
advantages of small enterprises, 96
control of by legislation in 18th century, 12
direct *vs.* indirect, 126–127
domestic system, 10–11
factory system of, 12–14
increase in power for, 2
industrial depression, 268, 272
industrial management outside the works, 268–281
law of diminishing returns, 91–92
overhead charge, 62
problem of, 265
records in, 252–253
standardization and specialization in, 77–90
Production unit,
advantage of small, 95
collection and control of capital needed, 19
cost of a plant, 129
efficient management defined, 9
importance of accounting, 44
importance of location, 43
importance of business judgment, 46–48
influence of inspection on size of, 96
location of, 100–110
model factory, 124–130
size of an enterprise, 91–97
standard unit enterprises, 90
Profits,
basis of, 4
" dumping " as a factor of, 70–76
relation of cost-keeping to, 46
supplanted by service, 268–274